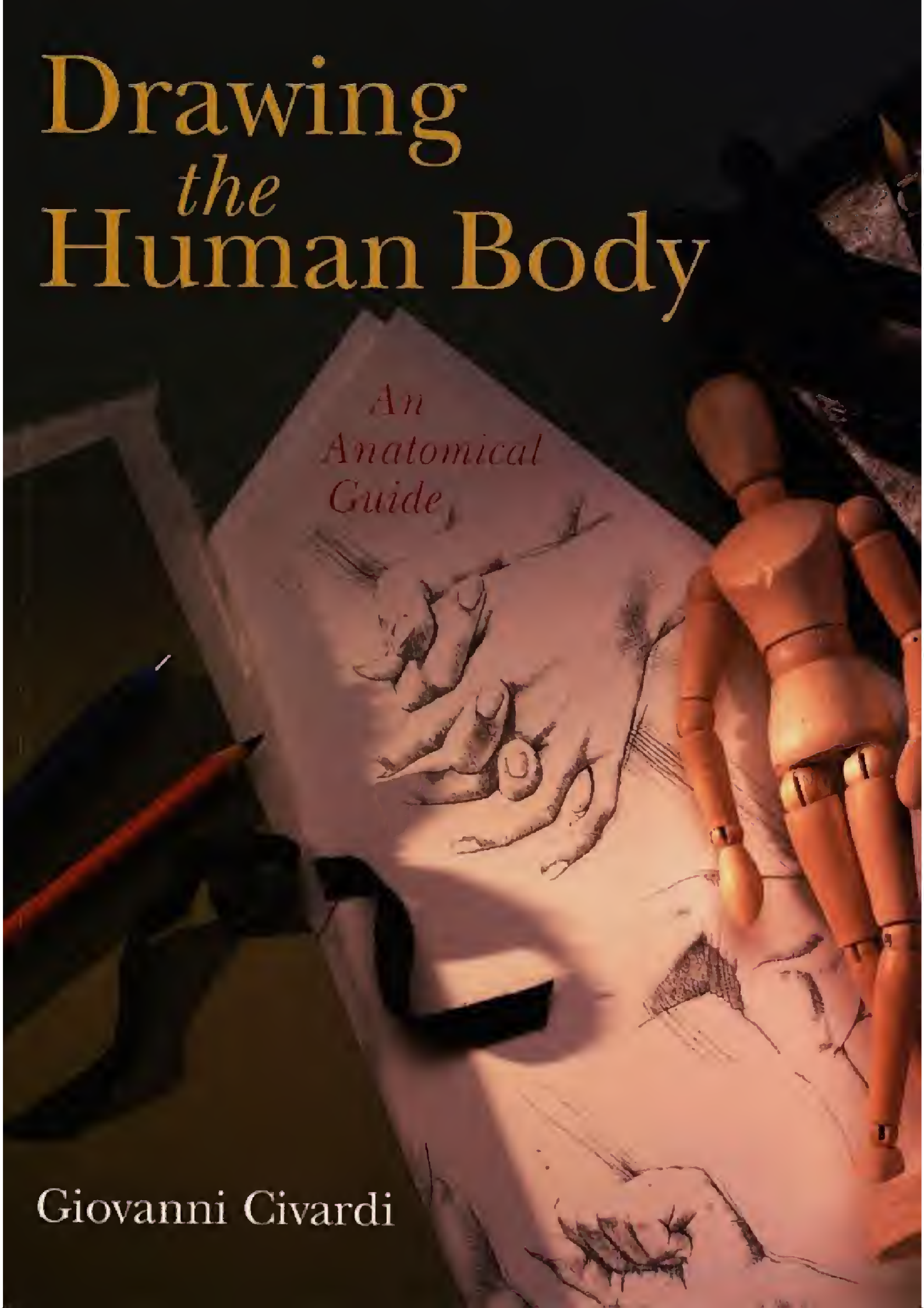
Drawing *the* Human Body



Giovanni Civardi

In dedicating this book, I wish
to express my gratitude to Professor Gottfried Bammes
(*Ordinarius em. Fur Kunstleranatomie,*
Hochschule fur Bildende Kunste, Dresden)
for honoring me with his friendship and for expressing freely
his honest and considered opinions on the significance of anatomy
in the art studio and in the formation of the artist

Translated by Rosa Iacono
Internal graphics by Grazia Cortese
All drawings by Giovanni Civardi
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Preface

The difficulty is not to make a work of art; but to enable oneself to do so.—Constantin Brancusi

The study of the human body, whether with the intent of rendering it for pictorial or sculptural recognition, can be approached through a variety of instructional methods. These tend, however, to follow two basic fundamental paths.

The first, definable as "perceptive" (gestalt), comes from comprehensive observation, attention, emotional impact, and a sharing of the subject as a whole, representing "what is seen." The other, definable as "constructive," places the major emphasis on the more rational aspect of perception to effectively represent "what is known" about the subject.

Defined in such brief summary, these two methods obviously appear confined to diametrically opposing paths. The lines of study are, however, sufficiently complex conceptually so that, if correctly intertwined, the two paths often integrate and strengthen themselves reciprocally. Mature and authentic artists tend to apply them in an appropriate manner with an almost sure instinct.

Modern schools of the art of drawing, with a distinct preference for the first process (which most certainly provides students with more immediate gratification), do not overlook incorporating the second, more traditional "academic" (in the best significance of the term) method, providing not only set rules or stereotypes but a foundation for the understanding of anatomy—an integral "lecture" on the human body. Didactic experience in this field, however, suggests to me a different combination of the two procedures. Remember, even if gained only from observation, precise anatomic information is indispensable for the solid preparation of an artist who is interested in the human body, strives for wider acceptance, and desires to comprehend fully and objectively what he or she wants to express, whether widely figurative or in the abstract.

Maybe, especially in these years of cultural and biological confusion, there comes a disorientation with regard to the human body (so-called "post-organic" interpretation, bone grafts, prosthesis, genetic manipulation, surgical alteration, anthropomorphized animals, computer construction of virtual reality, etc.). Yet, there is the desire "to know" and not remain in ignorance; the ability to choose–accept or refuse; and to alter based on knowledge, liberty, creativity, and autonomy.

Further, to complement more distinctly the parallel path in this way does not make it suffer; on the contrary, it becomes even stronger. This fact was affirmed to me recently with the happy announcement, "Everyone sees what they have learned to see."

This is the conviction that has guided my life's work and, in particular, this present book, in which I have tried to focus the artist's attention on the exterior form of the body and reveal, although synthetically, the underlying anatomic structure that determines the visible form.

This work is based on two preceding books published in Italian. To be completely honest, with regard to the iconography portion, the volume *Anatomia Artistica* is more scientifically based and closer to the traditional concept of anatomy. Full descriptions of the external aspects of the corporal regions and territories, however, are reproduced in this book. This book is further integrated and completed from *Schizzi di Anatomia Artistica*, a book of sketches published separately. *Schizzi* ("Sketches") contains more in-depth anatomic information (bone-joint myology) not included here in favor of much new information of more interest to the serious artist.

Here, the sketches are intertwined with anatomy notes as a guide for attentive observation by the artist, and by the merely curious, of the external morphology of the human body in its entirety, each of its regions one by one, and its variable individual aspects. Above all, this volume constitutes an invitation to observe and to research, through the close study of living models, the characteristics of bodily form and anatomy relative to design.

It can be useful to include certain technical notes leading to the realization of a book.

I requested a few years time in order to work diligently on it, since the drawings are almost all taken directly from actual models posing. The few exceptions that caused me to consult photographic documentation were due to such concerns as the uncertain position of a subject and the necessity to "fix" distinctly transitory muscular motions.

Instead of expressively interpreting the form, I preferred to document it using a rather neutral, almost linear art style. The method illuminates the model in a way that produces shade sufficient to delineate interesting detail and is in harmony with the intent to stimulate the studious to recreate "in life"—to exist with the model in the situation, instead of simply observing a design.

Each drawing was executed on small, smooth, 40-by-60 centimeter Bristol board, using pencils of various strengths.

Giovanni Civardi
Milan, September 1998

Structure of the Male and Female Body

(sketches 1–2)

For the study of structure and form (morphology) and for the purpose of anatomical description, the human body is observed in its most natural and characteristic, erect position with the upper joints hanging stretched alongside the torso, jaw up and forward, and lower joints extended and close together. This state is called the "anatomical position," to which references are made when describing the body's positioning and its spatial relationship and orientation to the corporal organs.

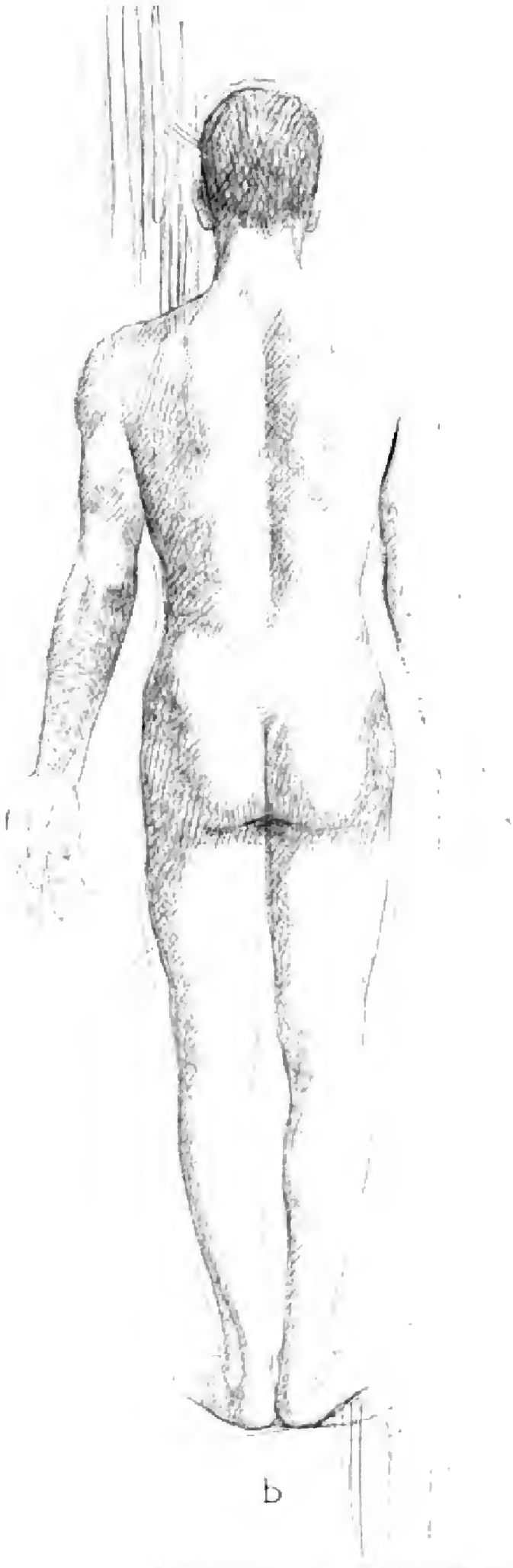
In this position, the body presents to the observer an anterior face (sketch 1a), a posterior face (1b) and a side view, or profile (1c). To study the human body in its entirety, it must be observed at sufficient distance (at least two yards) for a view comprehensive enough to gather together the general characteristics of the structure, for example: the relationship between body parts, sexual differences, muscular and skeletal formation, and the distribution of fatty membranes (panniculus). Observation of the frontal (or the back) view reveals the symmetry of the body in respect to the median sagittal plane and shows the transversal alignment of the shoulders to the pelvis, the relationship between chest and abdomen, and the axis of the lower joints. Lateral observation allows visualization of the corporal axis (which normally extends laterally from the outer ear to the anklebone). It also reveals the anterior profile of the torso, the curvature of the neck and back, as well as fatty and muscular consistencies of the abdomen, buttocks, and legs.

The muscles determine the comprehensive form of the human body, the skeleton (which constitutes the fundamental structure) on which they are massed, and of the fatty panniculus. The trunk (or axis), the principle part of the body, consists of an upper rounded portion (the head), a smaller, somewhat cylindrical middle portion (the neck), and an extensive lower portion in a flattened cylindrical form (the trunk or torso). Two appendages are connected to the upper part of the trunk, the upper limbs. Two appendages are also joined to the lower part of the trunk, the lower limbs, which extend from the bottom of the trunk to the floor.

A practical proportional assessment of the human body (see page 12) generally requires a comparison of width and length, choosing one unit of the body (for example, the head) as a unit of measure, which will also relate bone and muscular points of reference on the nude. The height of the head corresponds to the distance from the top of the cranium to the base of the chin.

The natural rule indicates that the total height of the body equals about seven and a half heads. The neck and the rest of the trunk measure in length about three heads, the maximum distance between the two protruding shoulder points is two heads, the maximum width of the buttocks is about one-and-a-half heads, the length of the upper limbs is equal to three heads, and the length of the lower limbs equals three and a half heads. Half of the body's height should be at the pubic level.

a.



b.

The relative proportional relationship of the female body is somewhat different than that of the male with regard to the characteristics of the muscles and the bones, and the protruding fatty tissue in the two sexes.

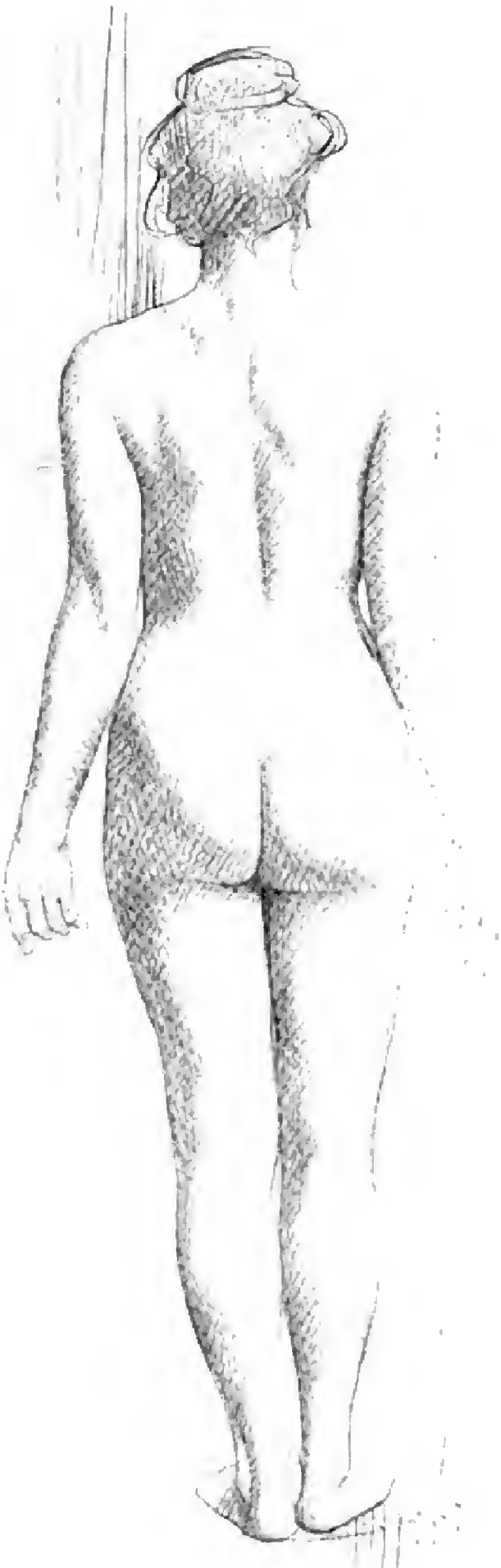
The most relevant morphological differences between the male body (sketch 1: 26-year-old model, 69 inches tall) and the female body (sketch 2: 23-year-old model, 64 inches tall) that have interest for the artist are "secondary" divisions. These prevalently regard the locomotive apparatus (the skeleton in particular) and the integument apparatus. In fact, the major part of the corporal differences between man and woman can be brought back to two fundamental facts: 1) the different reproductive compositions (the woman's pelvis is larger and shorter and the mammary glands are very developed); and 2) the different times of sexual maturation (development is more rapid in the female and determines minor dimensions and strength in the locomotive apparatus).

In the first approximation, the most relevant corporal differences are as follows:

Man: Tends to have an elongated head, a longer face, a flatter torso; his trunk is shorter in respect to his stature; he has a longer humerus and femur in relation to total length of the limbs; and a straighter and longer pelvis. Hair is distributed on the face, torso, and forearms; pubic hair extends near the naval.

Woman: Tends to have a more rounded head, shorter face, more profound torso, relatively long trunk in relation to stature, relatively shorter humerus and femur, major development of subcutaneous fat (breasts, buttocks, and legs). Longer hair on head, but minor amounts on body; pubic hair delimited horizontally. The pelvis is short and wider than the shoulders. Inclination of the axis of the upper and lower limbs is more accentuated. The rib cage is more curved in the upper part of the torso.

a



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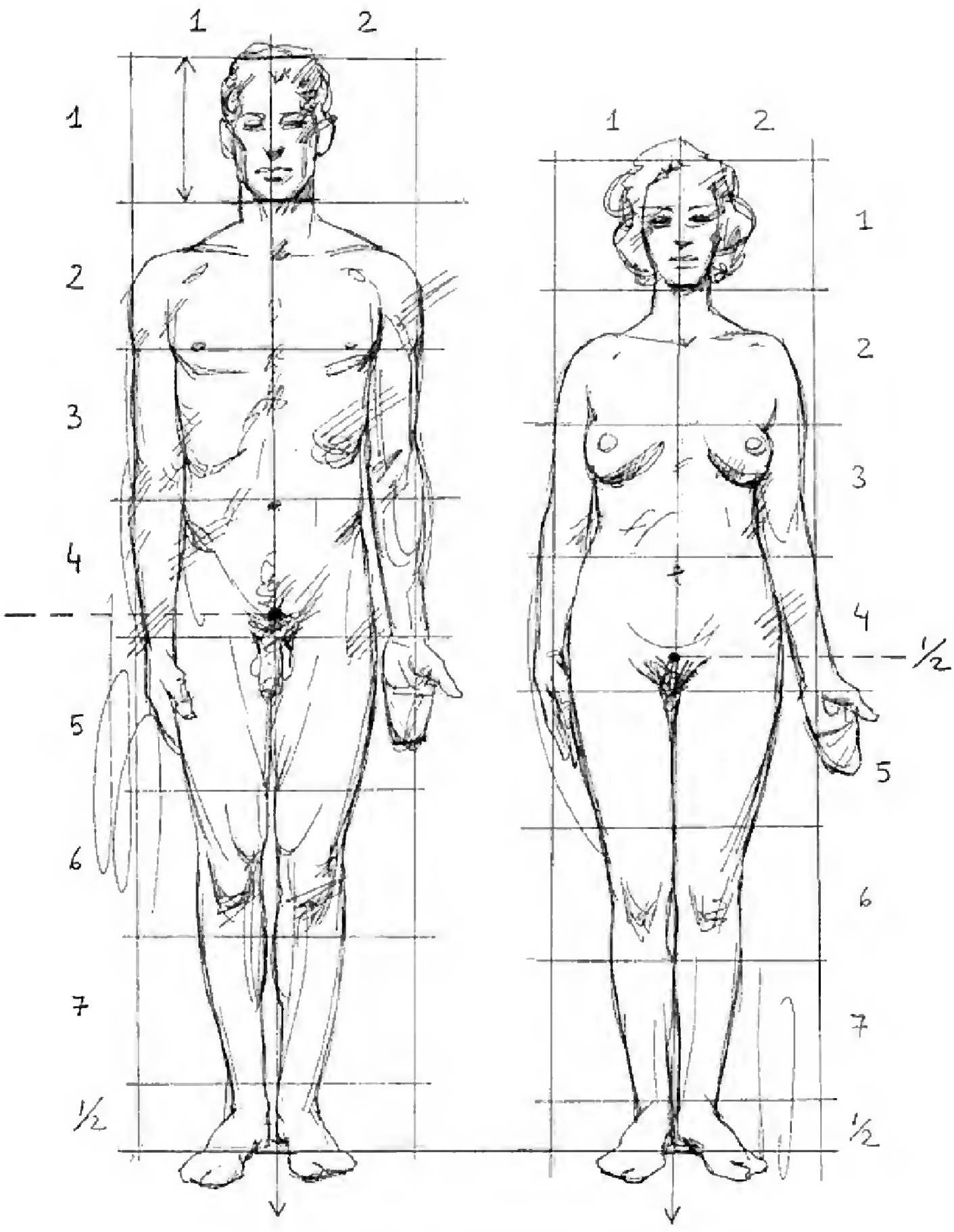
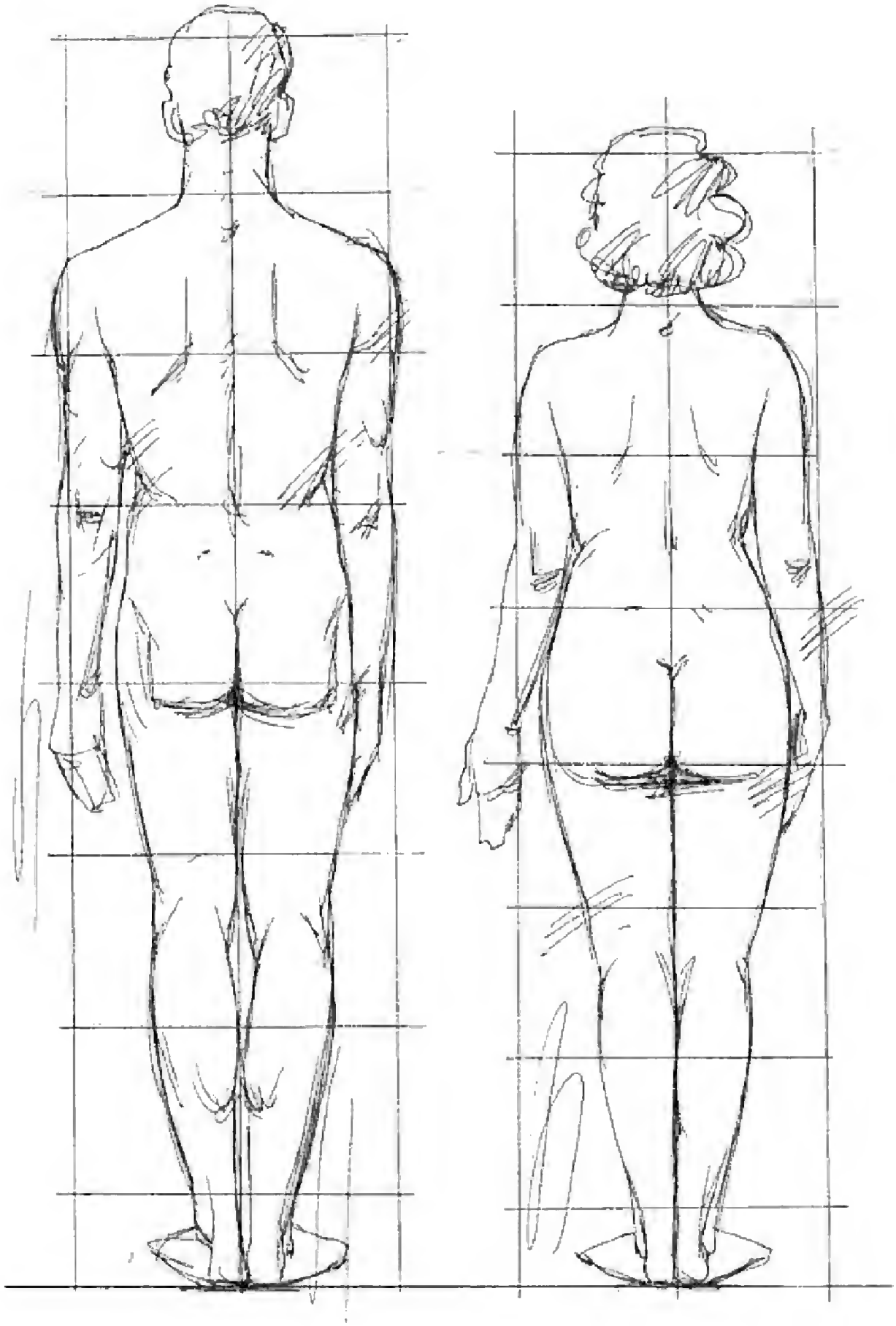
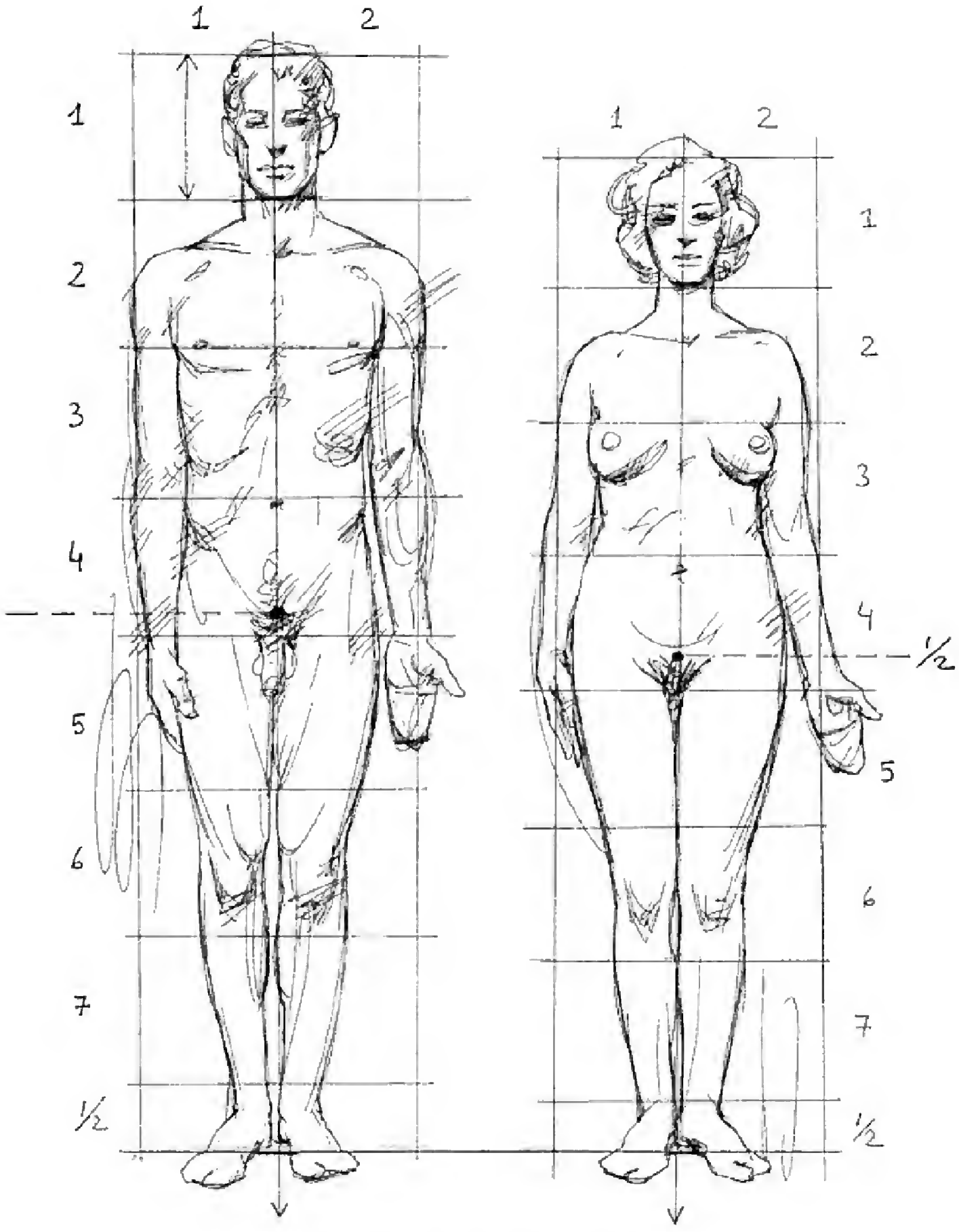


Outline of the proportions of the adult human male and female bodies, according to a "scientific" scale





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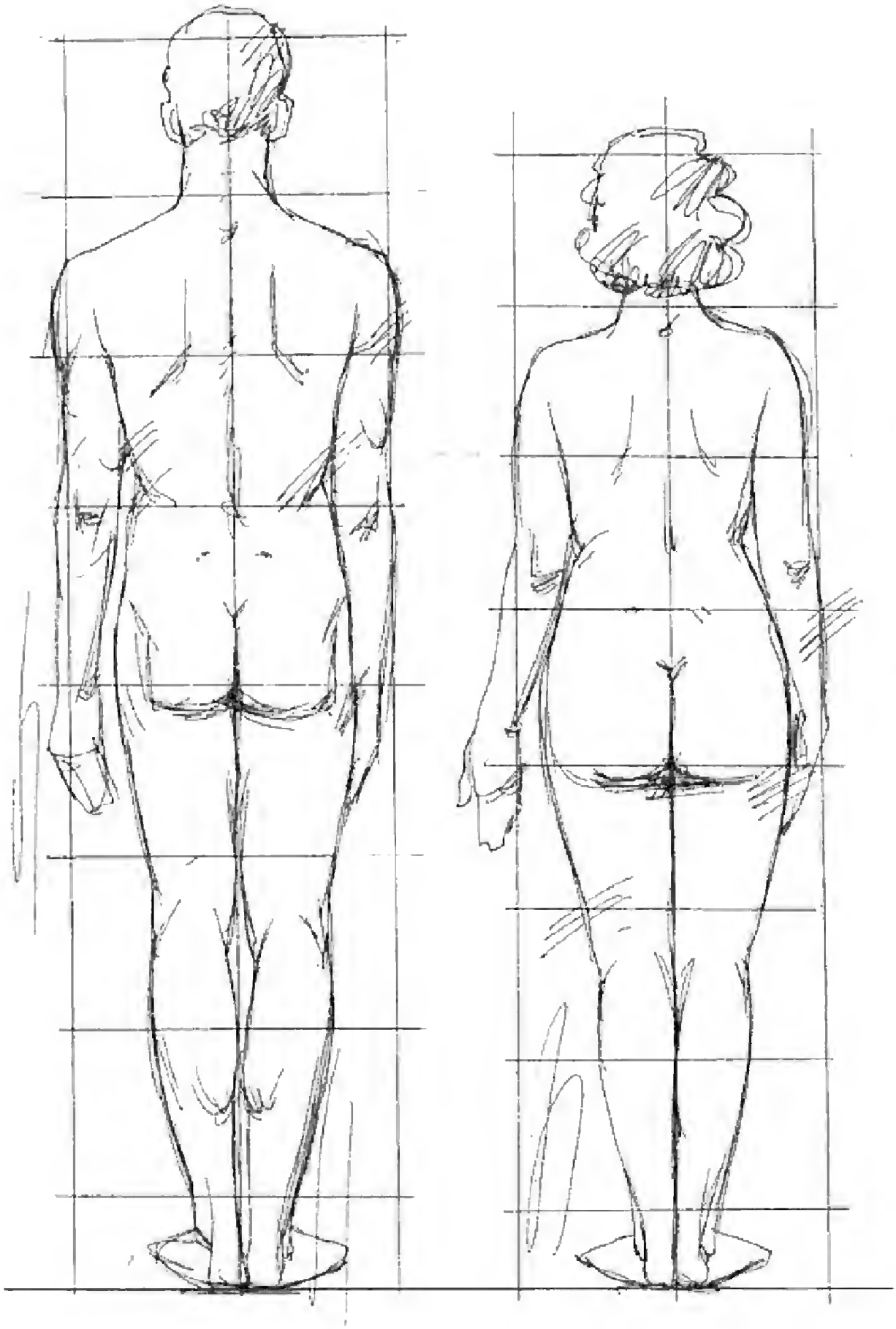

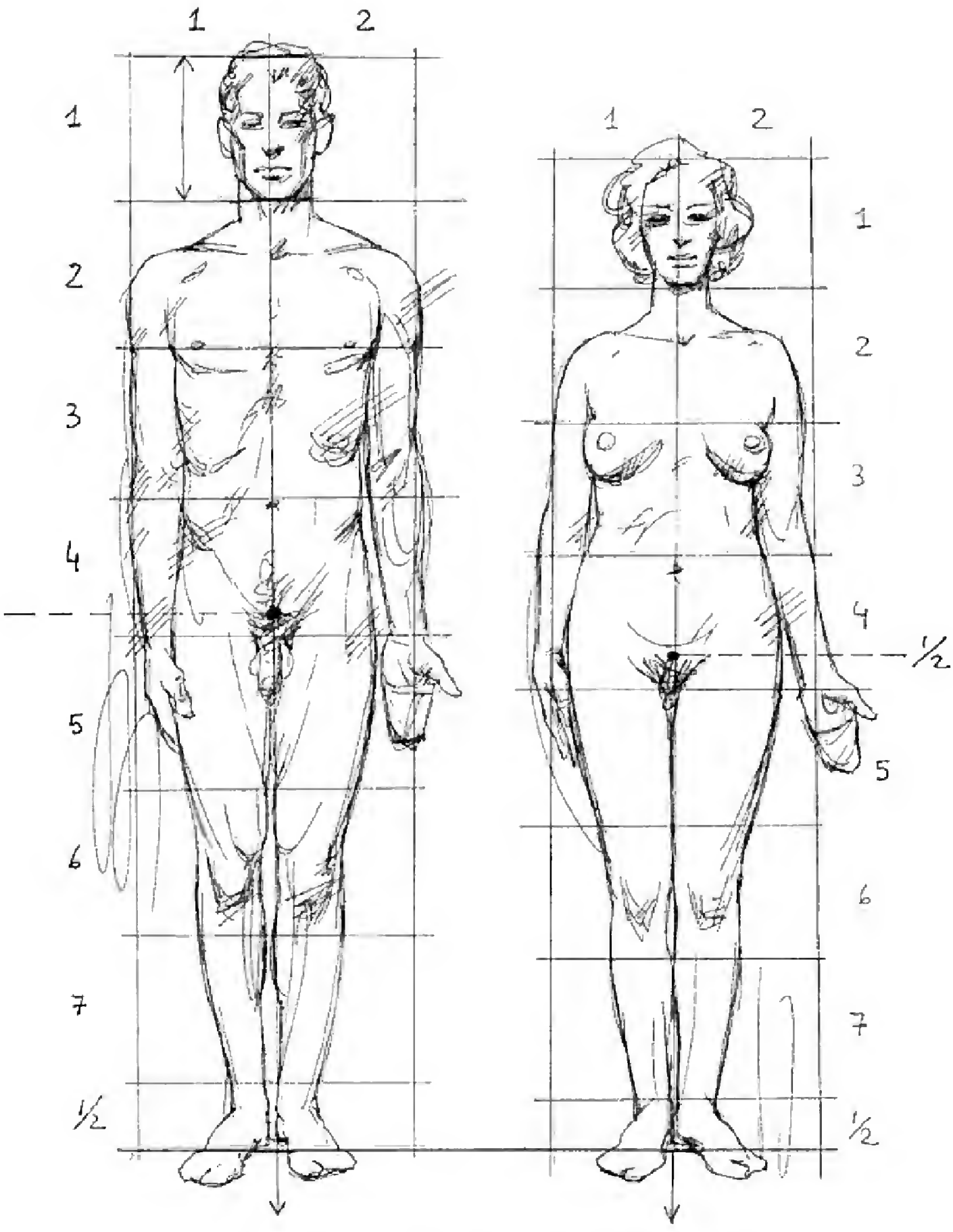

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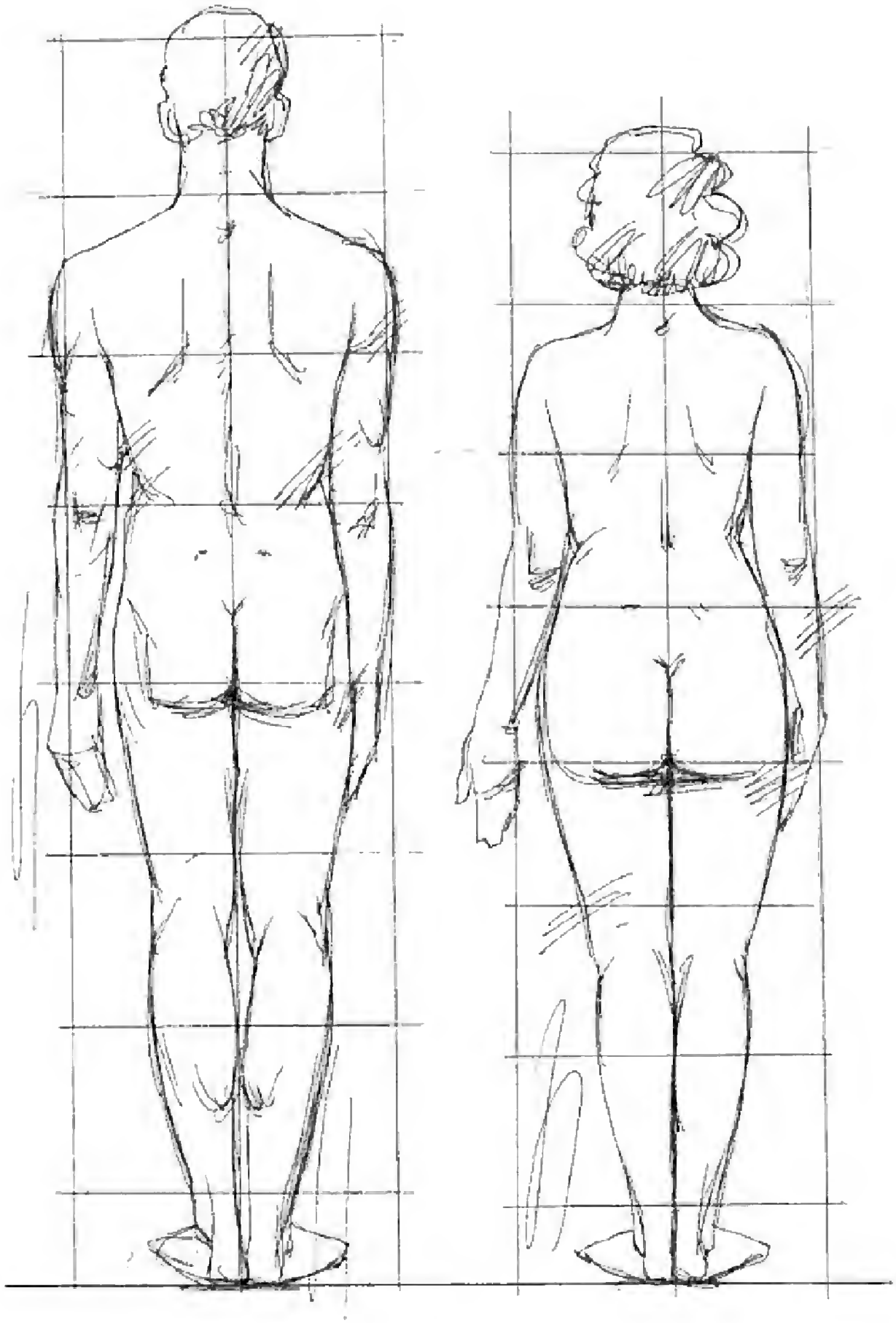
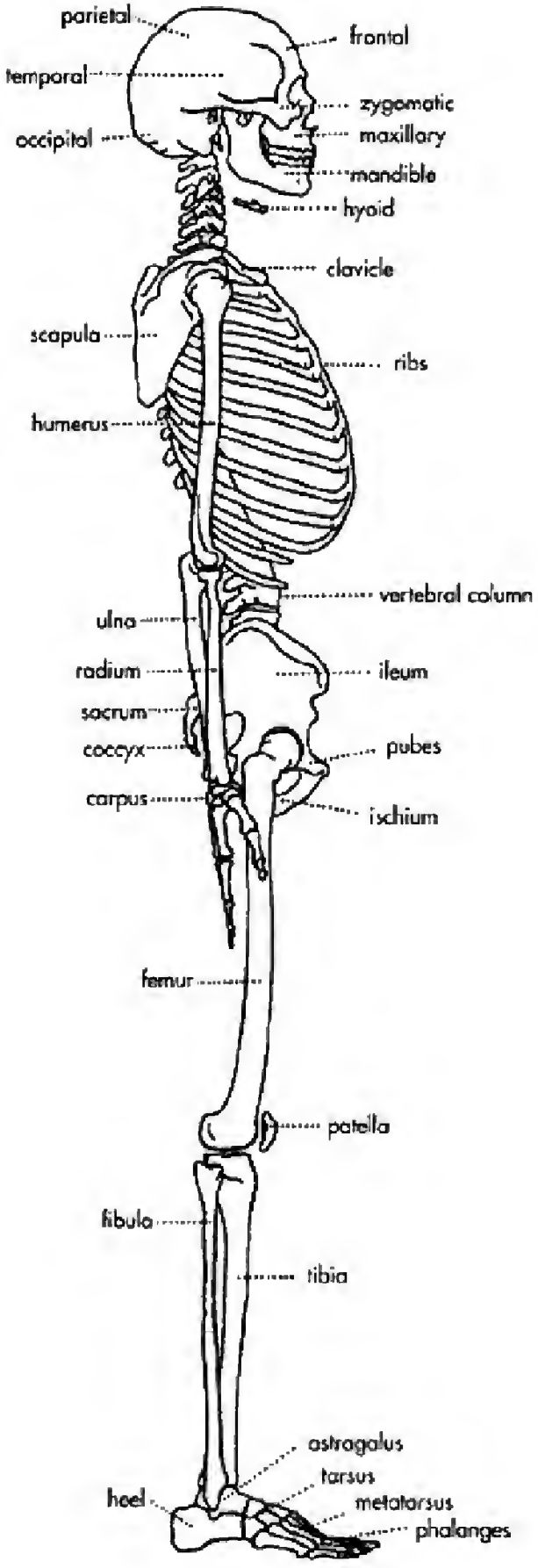
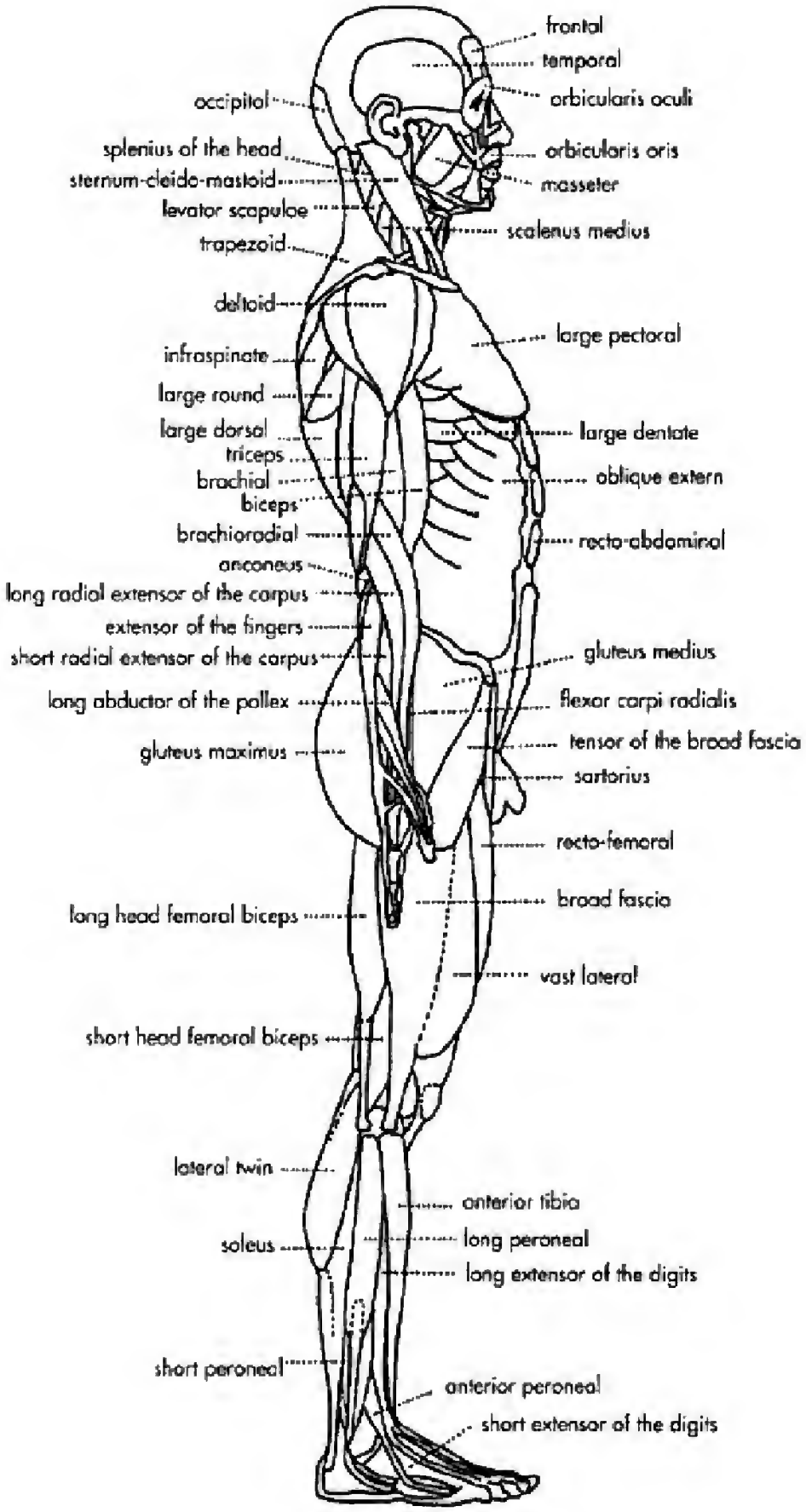
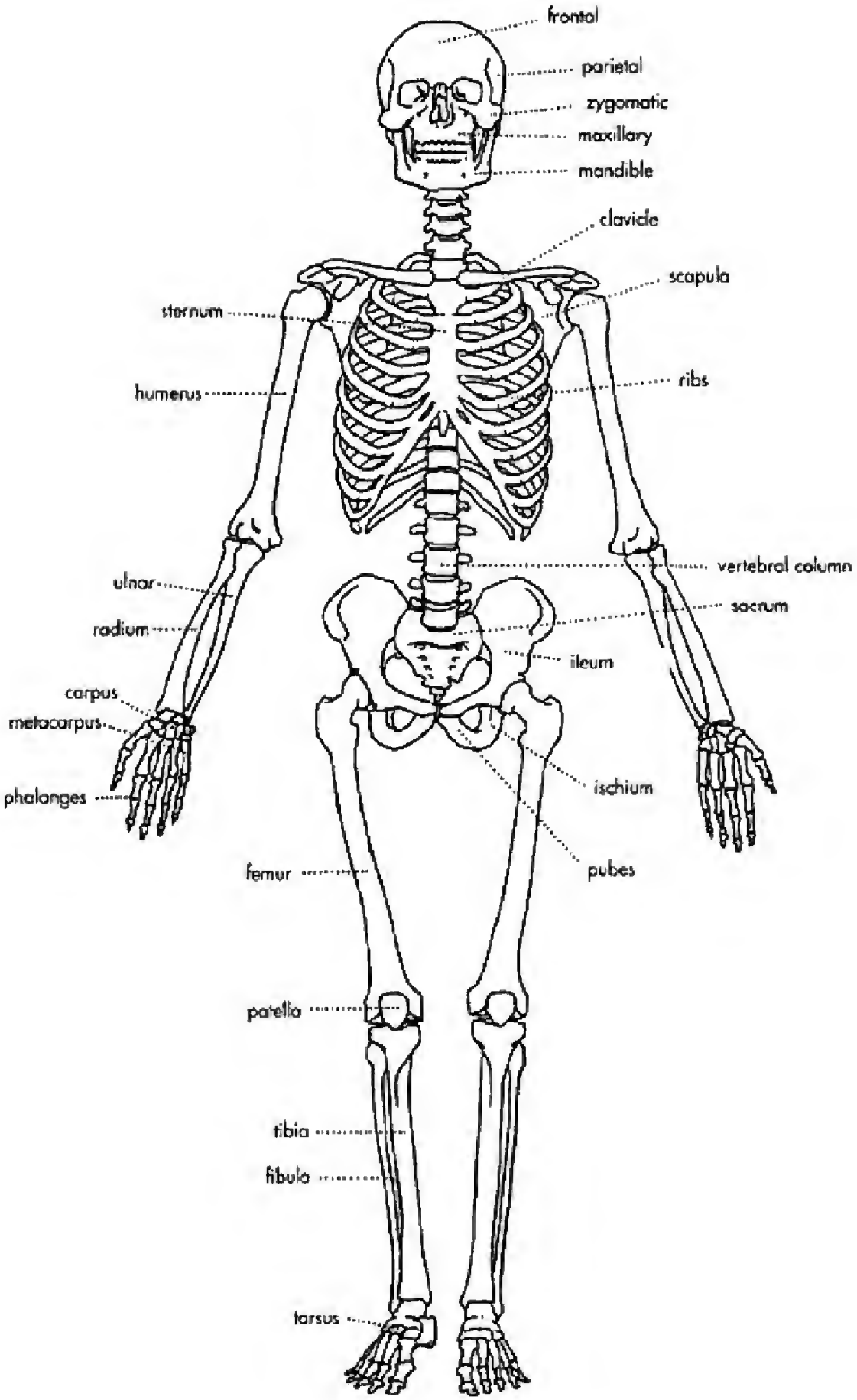




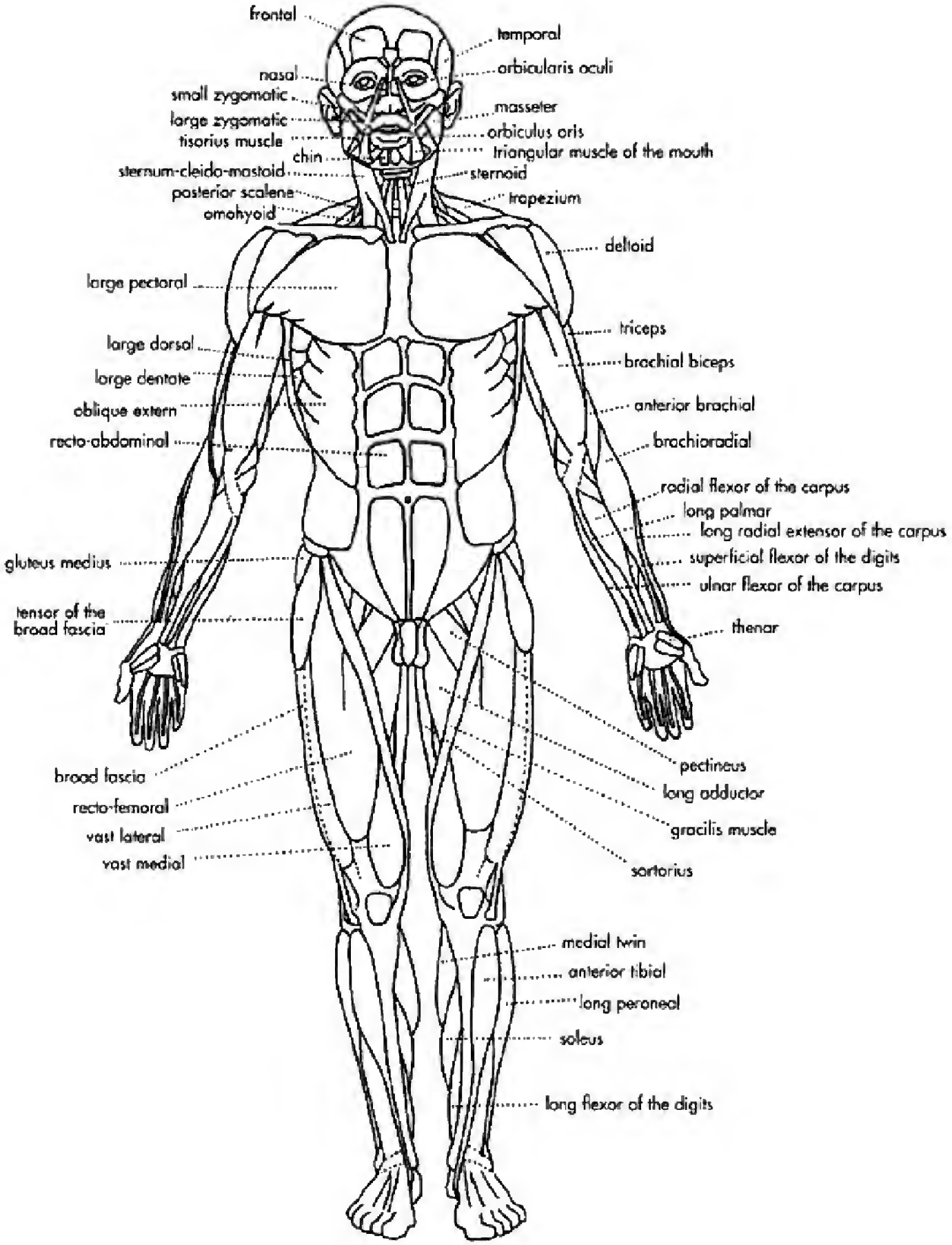
Outline drawing of the skeleton (male): lateral projection



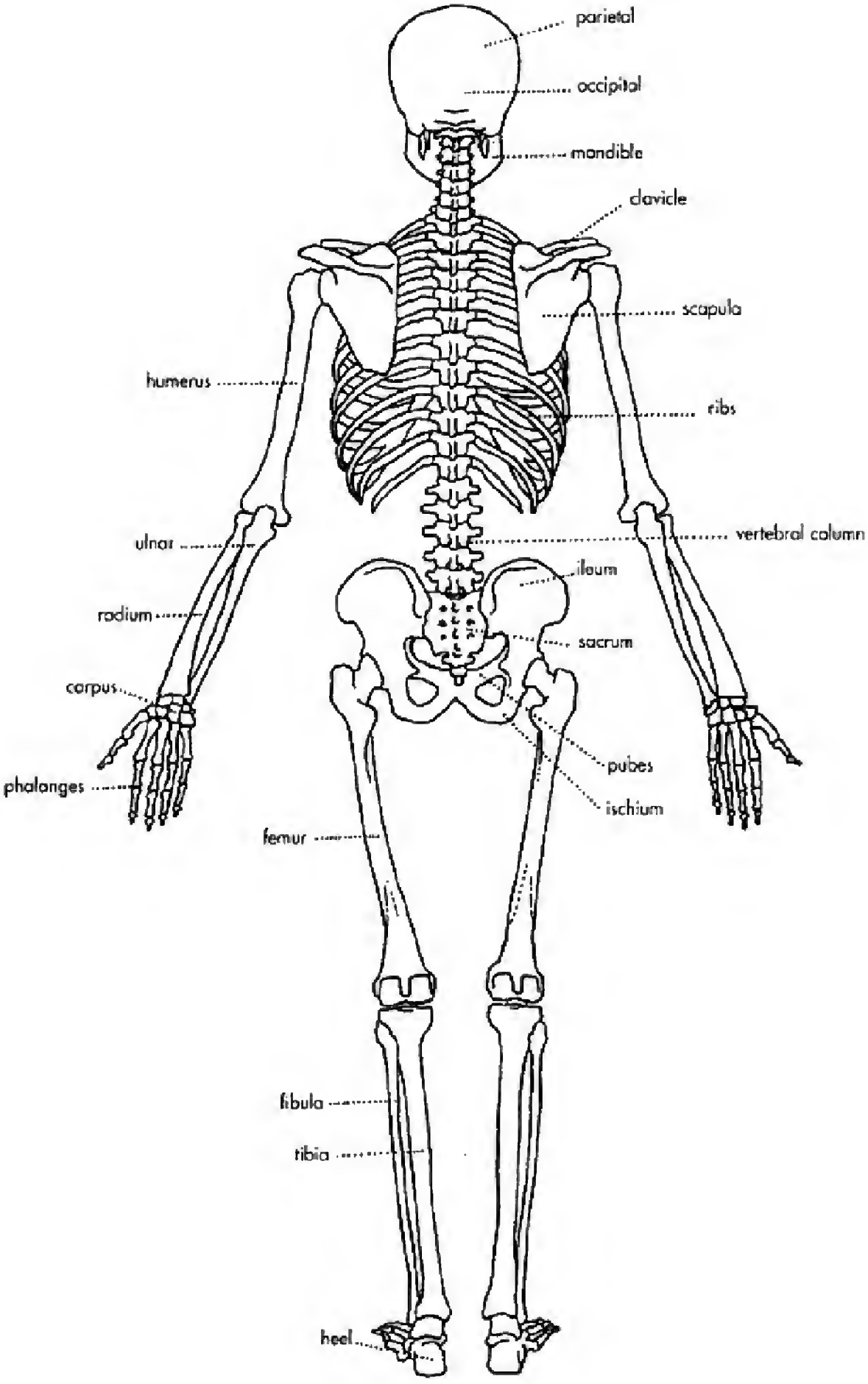
Outline drawing of the superficial muscles: lateral projection



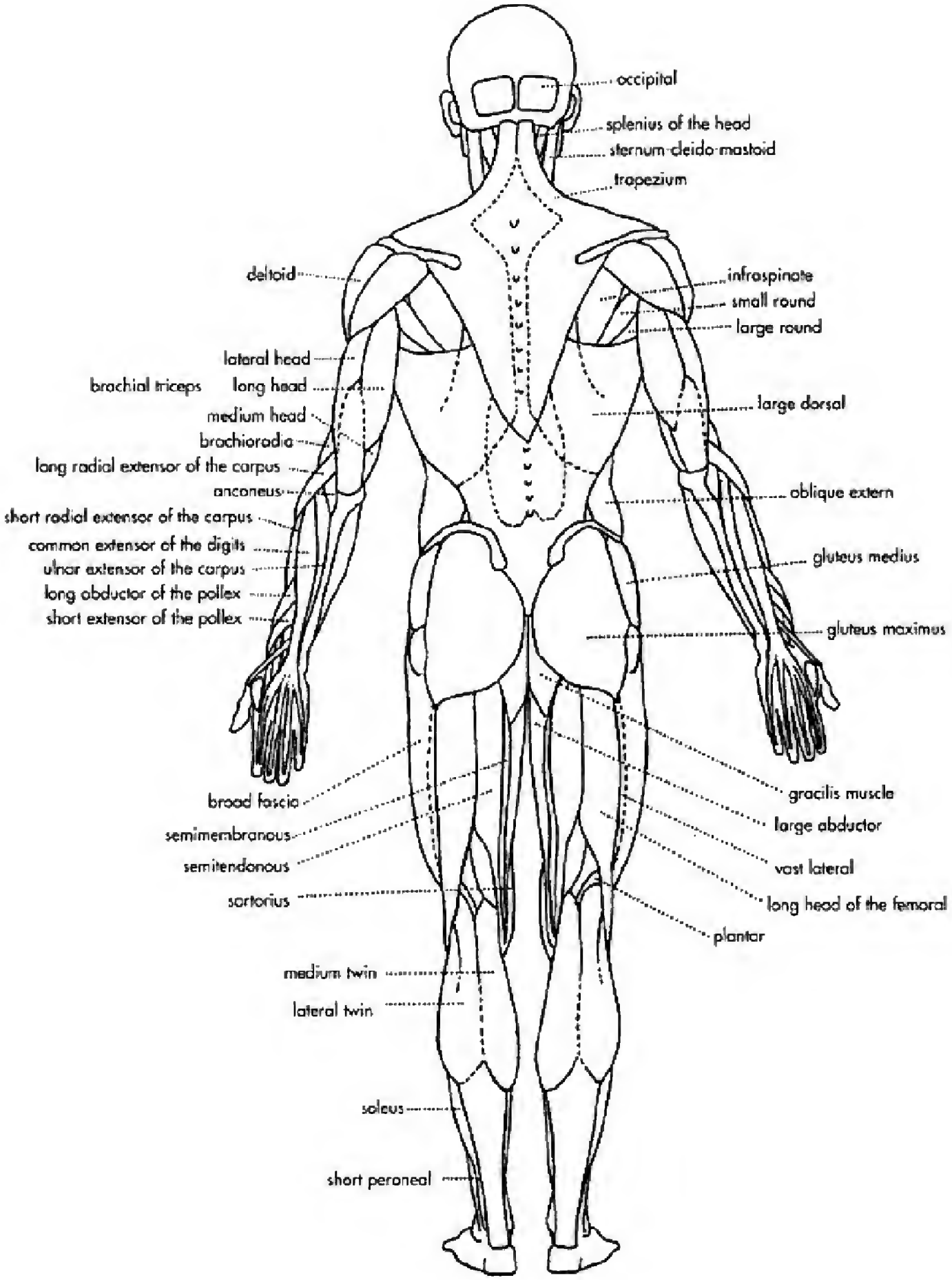
Outline drawing of the skeleton: frontal projection



Outline drawing of the superficial muscles; frontal projection



Outline drawing of the skeleton (male): dorsal projection



Outline drawing of the superficial muscles: dorsal projection

The Head

(sketches 3–11)

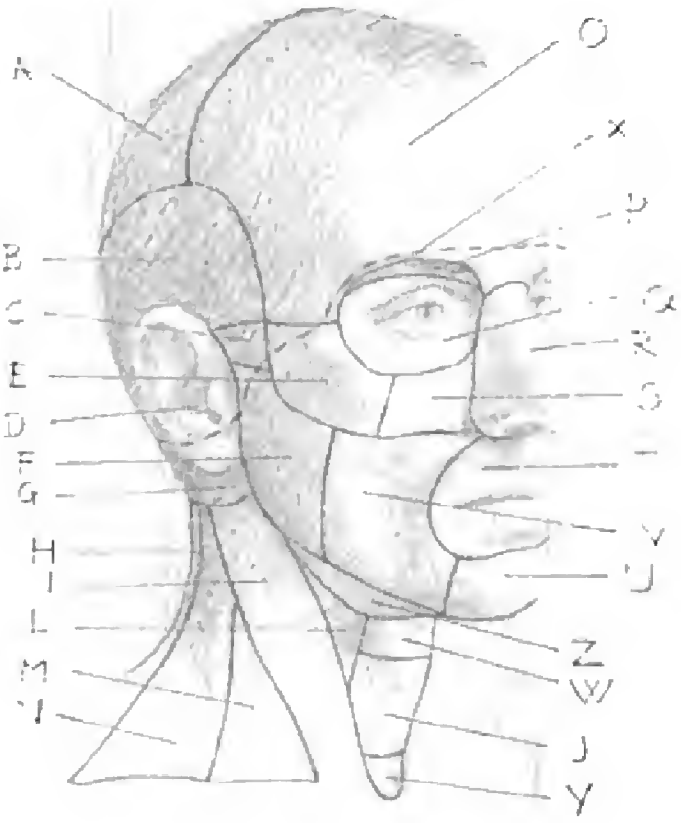
External Morphology

The head is the uppermost part of the human body, situated above the vertebral column and joined to the body by the somewhat cylindrical, more restricted segment, the neck. The head has a complex rounded, ovoid form, and is distinguished into two portions: the cranium, which is the more elevated quasi-spherical or elongated ovoid part; and the face, or the part lying beneath the cranium. The face is also ovoid in shape, but more elongated vertically. The outer limits of the cranium and face are outlined by two lines beginning at the roots of the nose and following the arched orbitale, the posterior limit of the zygomatic bone, and the external acoustic opening and rejoining in the proximity of the apex of the mastoid, the line of division between the head and the neck (see sketch 3). Overall, the external morphological division differs from the osteological mainly because the forehead is also considered part of the face, defined by the line of attachment of the implanted hairs in the skin (scalp) that covers the cranium.

The bones of the face, particularly complex and covered by numerous subcutaneous muscles, contain cavities in which the principle sensory organs are lodged (beyond the first passages of the digestive and respiratory apparatus). On the external, numerous conformations of relevant interest are noted also for artistic representation; for example: the slightly arched forehead; the eyebrows, corresponding in part to the arched orbit; the eyes, contained in two orbit cavities; the nose, an elongated pyramidal protrusion on the middle axis of the face; the upper and lower lips, which outline the oral cavity and cover the teeth; the cheeks; and the concave cartilage of the outer ears, which are post-symmetrical to the sides of the head.

Sketch 3: Principal regions of the head and neck

A - Parietal
B - Temporal
C - Intra-temporal
D - Auricular
E - Zygomatic
F - Maxillary
G - Mastoid
H - Nape
I - Sterno-cleido-mastoid
L - Carotid
M - Super-clavical
N - Lateral of the neck
O - Frontal
P - Upper-orbital
Q - Orbital
R - Nasal
S - Lower-orbital
T - Labial
V - Genio
U - Mental
Z - Lower-mandibular
W - Hyoid
J - Suprahyoid
Y - Upper-sternal
X - Limiting line of cranium and face



Sketch 3: External morphology of the male head

1 - Projection of the arch of the zygomatic, which runs under the skin.
2 - The action of the muscles that work under the upper lip, a slight fatty deposit, the diminishing elesticity of the skin and individual repeated movements cause a skin projection outlined below the nasal-labial crease.
3 - The base of the nose has a triangular form, and the nostril openings converge towards the lobes.
4 - At the front of the masseter, a fatty area shades the anterior borders of the muscle and smooths the passage of the outer skin towards the cheeks.
5 - Protuberance of the lower border of the mandible: a variably inclined plane which, according to the position the head assumes, joins the neck.
6 - Weak ovoid projections, determined by the overlapping of the orbicular muscles of the mouth, of some fascicles coming from muscles near the active angles of the mouth.
7 - The upper orbital border is more pronounced in respect to the ocular bulb.

Artists of the past took attentive and profound care in their study of human expressions and in reproducing them exactly. Think of the paintings and sculptures of historical or celebrated figures or the religious icons that dominated until almost the twentieth century. In the decades since, and into contemporary times, interest in realistic representation of the art figure has progressively weakened, remaining alive primarily in portraiture and illustration. In any case, to design facial expressions well, these basic considerations should prove valuable.

Designing a truly expressive gesture becomes easier if the characteristics are developed and refined as a whole (else they become caricatures), omitting such minute and marginal details as, for example, an excessive analysis of small wrinkles.

The expression of the face alone is very significant, but one should not overlook that the gestures of the entire body collaborate in manifesting state of mind. The effect of a particular study could be countermanded by the thoughtless angle of the hands or an improper relationship between the head and shoulders.

A single mimicry muscle seldom works individually but in syntergy—at times in opposition—to determine the complex and delicate changes of the skin. Since the expression appearing on the face is transient and fleeting (although habitual repetition of some gestures writes "character lines" on the individual's face), the knowledge of anatomy must be integrated with attentive observation and, if possible, the study of sequential photographs, movies, or videos. Illustrators often study their own faces, mimicking in a mirror, and sometimes arranging for points of view other than frontal.

Facial expression is best studied by looking at three groups, each characterized by a dominant tendency:

Neutral: The face does not show muscular contractions or skin alterations; the components are found only in normal anatomical relationships with slight nuances that consent to be recognized as the expressions of serenity, decision, or moderate attention.

Positive: The face seems to dilate, as if subjected to the thrust of centrifugal tension. The enlargement of the mouth, the dilation of the eyelids, and the elongation of the eyebrows denote, in general, "optimistic" expressions: laughter, smiling, surprise, and happiness. This individual has nothing to fear in the external world, so opens him- or herself up with pleasure.

Negative: The face seems to contract under pull of centripetal pressure. The shortening eyebrows, closing eyes, curling nose, and downward curving lips denotes "pessimistic" expressions: crying, pain, disgust, sadness, skepticism, and anger. An individual fearing aggression or threatening hostility "closes up," to protect and defend. Intense aggressiveness (anger, suffering, terror) causes the dilation of the nostrils and opening of the mouth which presents a more threatening and visually protective mask; the changes also augment the taking in of air, in line with the physiological situation of fight or flight.

Sketch 10: Basic expressions

1 - Sarcastic
2 - Joyful/laughing
3 - Surprised/astonished
4 - Scornful
5 - Angry
6 - Contemptuous/disgusted

Muscular Mechanism and Expression

Serenity, Meditation, Reflection

Eyebrows are drawn near and shortened, forming two or three vertical wrinkles in the middle of the forehead. Eyelids are half or fully closed, but are not contracted. Muscles used: corrugate of eyebrows, spherical mouth.

Attention, Awe

Eyebrows are raised at the arch, causing some wrinkling of the forehead. Eyelids are enlarged, and mouth slightly open. Muscles used: frontal and occipital, elevator of the upper eyelid, shorteners of the mandible.

Pain, Agony

Eyebrows are raised and drawn near, with head tilted slightly upward; they form transversal and vertical wrinkles only mid-forehead. The gaze is directed upward. The lips are contracted. Muscles used: corrugate of the eyebrows, frontal (median portion), elevator of the upper eyelid, quadratic of the upper lip, triangular of the mouth. At times: temporal, masseter, platysma.

Prayer, Invocation, Ecstasy

Eyebrows are completely raised, the gaze direct and upward, and the mouth half closed; this forms transversal wrinkles on the forehead. Muscles used: frontal, elevator of the upper eyelid, small zygomatic.

Smile

Mouth is partially or totally closed, lips pulled slightly curve upward. The nasal-labial crease is accentuated, with slight dimples formed on cheeks. Lower eyelids are slightly raised and form small creases at the base and across the temple. Muscles used: spherical of the eye (lower portion, eyelid), small zygomatic, and nasal.

Laughter

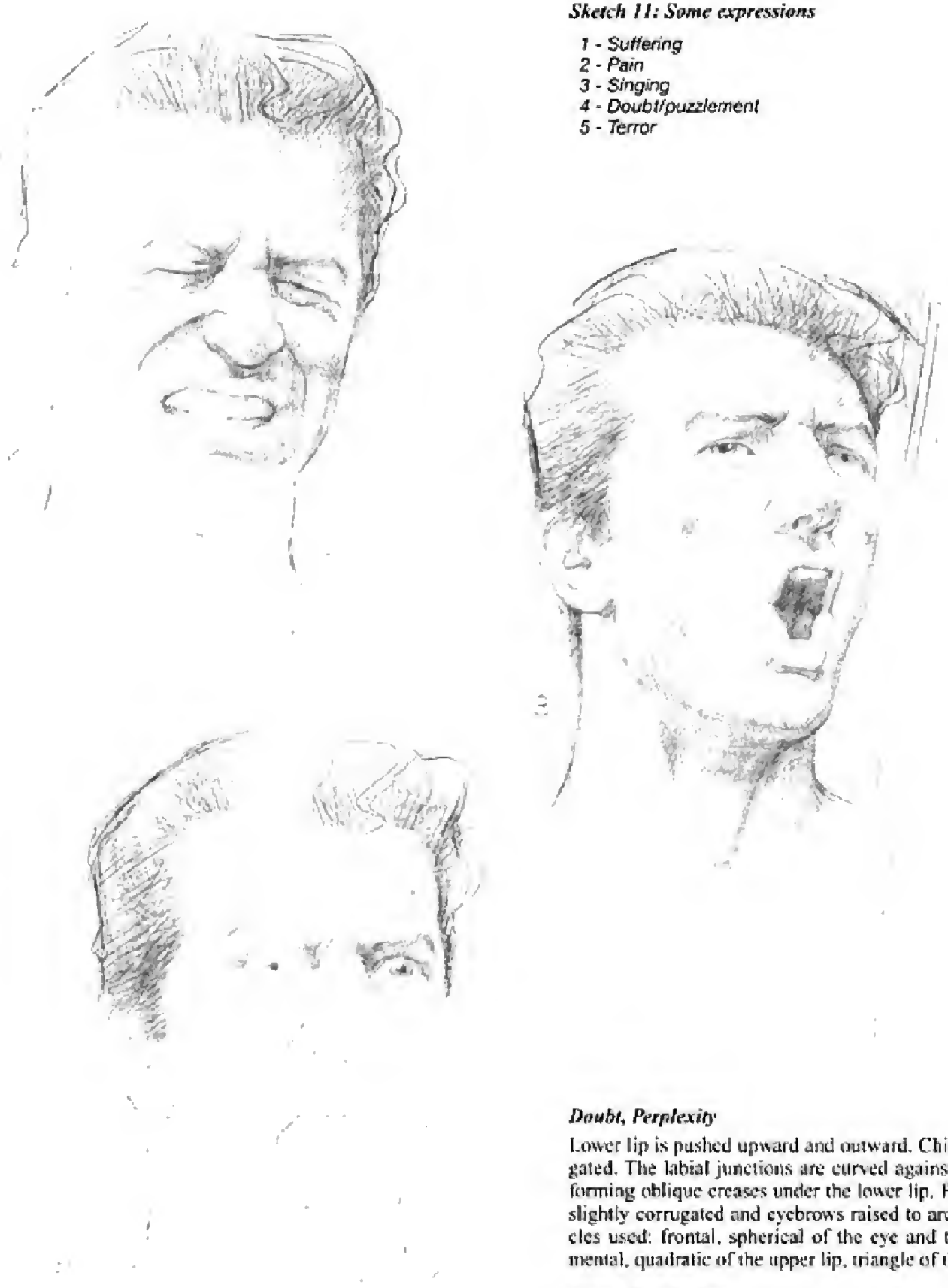
Eyes are half closed and mouth is partially open, with a concave arch across the upper lip. Eyebrows are raised slightly. The nasal-labial crease is marked, the nostrils dilated. Long creases are formed under the eyelids and at the temples. Muscles used: spherical of the eye, nasal, and quadratic of the upper lip and large zygomatic.

Crying

Eyes are partially closed, eyelids contracted, and forehead corrugated. Dilated nostrils form small wrinkles on the sides and back of the nose. Mouth is slightly open and assumes a quasi-quadrilateral form, with the lower lip curved downward and the formation of oblique creases on the seam of the chin. The chin becomes corrugated, and long creases are formed on the neck (platysma). Muscles used: corrugate of the eyebrows, spherical of the eye, quadratic of the upper lip, triangular of the lips, mental.

Disgust, Contempt

Eyebrows are drawn together and slightly raised, forming vertical wrinkles on forehead; lower part pushes slightly upward and outward. The labial junction is shortened, the chin corrugated, the nasal-labial path is pulled upward at the upper extreme and downward in the lower. Muscles used: spherical of the eye and of the mouth, quadratic of the upper lip, triangular of the lips, corrugate of the eyebrow, mental.



Sketch 11: Some expressions

1 - Suffering
2 - Pain
3 - Singing
4 - Doubt/puzzlement
5 - Terror

Doubt, Perplexity

Lower lip is pushed upward and outward. Chin is corrugated. The labial junctions are curved against the base, forming oblique creases under the lower lip. Forehead is slightly corrugated and eyebrows raised to arches. Muscles used: frontal, spherical of the eye and the mouth, mental, quadratic of the upper lip, triangle of the mouth.

Anger, Wrath, Rage

Eyebrows are shortened and strongly drawn together, forming transversal creases mid-forehead and transversal ones at the root of the nose. Eyes are well open. Lower eyelids are slightly raised, and wrinkles radiate laterally from the base. The mouth can be closed tight or open (the nasal-labial crease elongates and deepens). The cheeks enlarge against the jaws. Muscles used: corrugate of the eyebrow, spherical of the eye, nasal, canine, quadratic of the upper lip, masseter, and platysma.

The Trunk

(sketches 12–39)

External Morphology

(sketches 12–17)

The trunk, or torso, is the axis part of the human body, excluding the head. It is separate from the upper and lower limbs, which constitute the appendages of the body. The trunk, taken as a whole, has a cylindrical yet slightly flattened shape. It can be subdivided into an upper tract, or thorax, and a lower tract, or abdomen.

On the abdomen, the major axes are slightly inclined on the arched plane, following the curvature of the vertebral column. They come together on sectors of the neck (a cylindrical segment in conjunction with the head), the shoulders, and the buttocks for a more organic description of the form. The thorax section, corresponding to the breastplate, has a trunk form, more flattened in an anterior-posterior sense, with the base stretching over the abdomen. On its anterior face, the pectoral projections can be recognized. They are separate from the slight sternum depressions, and the upper part is outlined by the projection of the clavicle. On the posterior face, the dorsal region corresponds to the vertebral column and is outlined by the sides of the shoulder and rib regions. The presence of the shoulders augments the extent of the upper thorax tract.

The abdominal sector has an ovoid form. It is held up only by the lumbar of the vertebral column and enclosed below by the pelvic bones, while large muscles form the other inner portions. On its anterior face, the umbilical cicatrix is found in the slight depression of the median line, or face; the external genital organs are situated at the lower extremity.

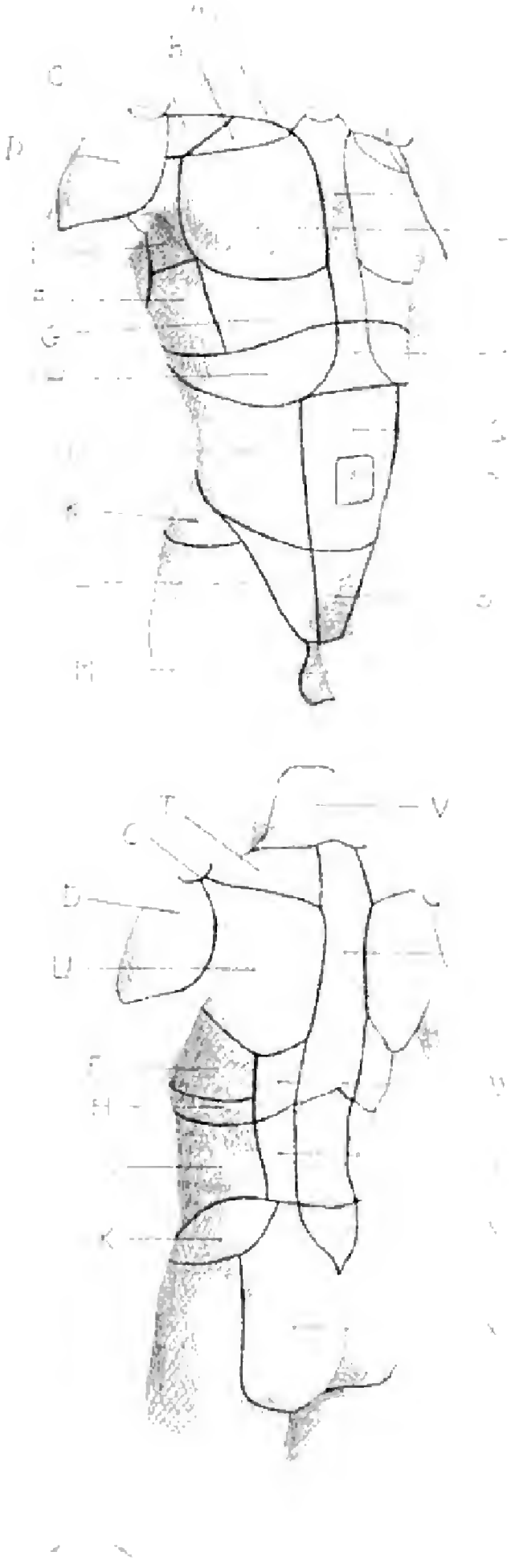
The posterior and lateral surfaces continue in the regions of the sacrum, the hip, and the gluteus. They also continue onto the surface of the legs, except for the median posterior tract where the lower buttocks are outlined by a clear skin crease.

Morphological Differences by Gender

(sketches 12–19)

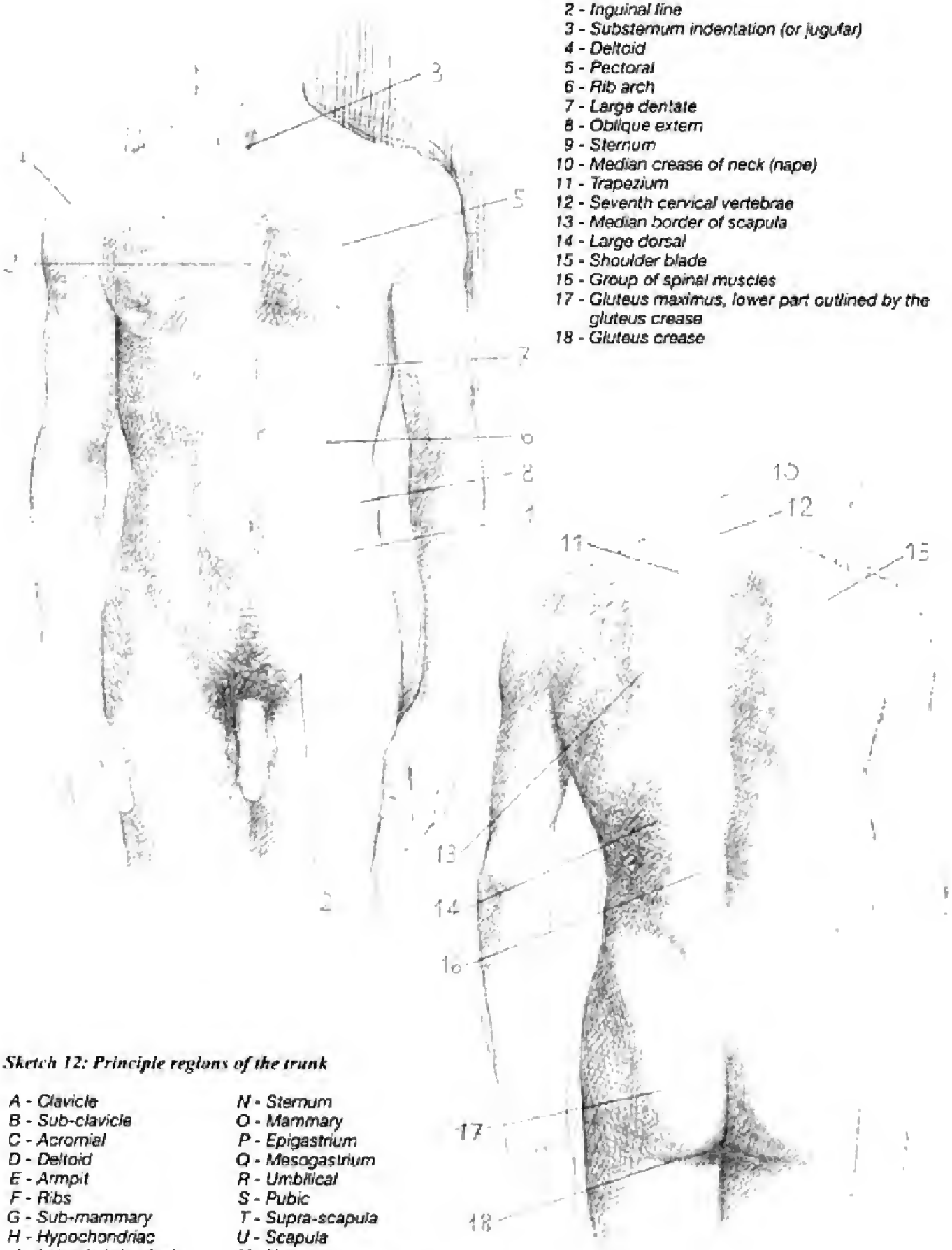
Comparing the trunks, or torsos, of the adult male and female reveals obvious differences (breasts, external genital organs, etc.). The artist must attentively consider these. For example, in the masculine body, the overall volume of the trunk progressively reduces from the shoulders to the hips, while the opposite happens in the feminine body, depending on the overall skeletal structure. In the male, development of the shoulders is predominant in respect to that of the pelvis. In the female, the reverse tendency is encountered, where the width of the pelvis is greater to that of the shoulders. The measurements are joined by the anterior and superior iliac spines and between the acromion processes.

In pelvic formation, the male/female difference is quickly revealed. The differing dimensions are easily observed (wider width, larger inclination, and shorter length in the female pelvis). The slight characteristic indentations in the sacral region correspond to the upper posterior iliac spines.



Sketch 12: Formation of the male trunk

1 - *Iliac line*
2 - *Inguinal line*
3 - *Substernum indentation (or jugular)*
4 - *Deltoid*
5 - *Pectoral*
6 - *Rib arch*
7 - *Large dentate*
8 - *Oblique extern*
9 - *Sternum*
10 - *Median crease of neck (nape)*
11 - *Trapezium*
12 - *Seventh cervical vertebrae*
13 - *Median border of scapula*
14 - *Large dorsal*
15 - *Shoulder blade*
16 - *Group of spinal muscles*
17 - *Gluteus maximus, lower part outlined by the gluteus crease*
18 - *Gluteus crease*



Sketch 12: Principle regions of the trunk

A - *Clavicle*
B - *Sub-clavicle*
C - *Acromial*
D - *Deltoid*
E - *Armpit*
F - *Ribs*
G - *Sub-mammary*
H - *Hypochondriac*
I - *Lateral abdominal*
J - *Sub-scapula*
K - *Iliac*
L - *Inguen*
M - *Genital*
N - *Sternum*
O - *Mammary*
P - *Epigastrium*
Q - *Mesogastrium*
R - *Umbilical*
S - *Pubic*
T - *Supra-scapula*
U - *Scapula*
V - *Nape*
W - *Sub-scapula (dorsal)*
X - *Gluteus*
Y - *Sacral*
Z - *Spine*

The pelvic border, or iliac crest, is very important from an art designer's point of view because it is visible, sub-skin, for a major part of its stretch, particularly anteriorly (iliac blades). These reference points are indispensable to the artist in deducing the correct positioning of the pelvis in the various body positions.

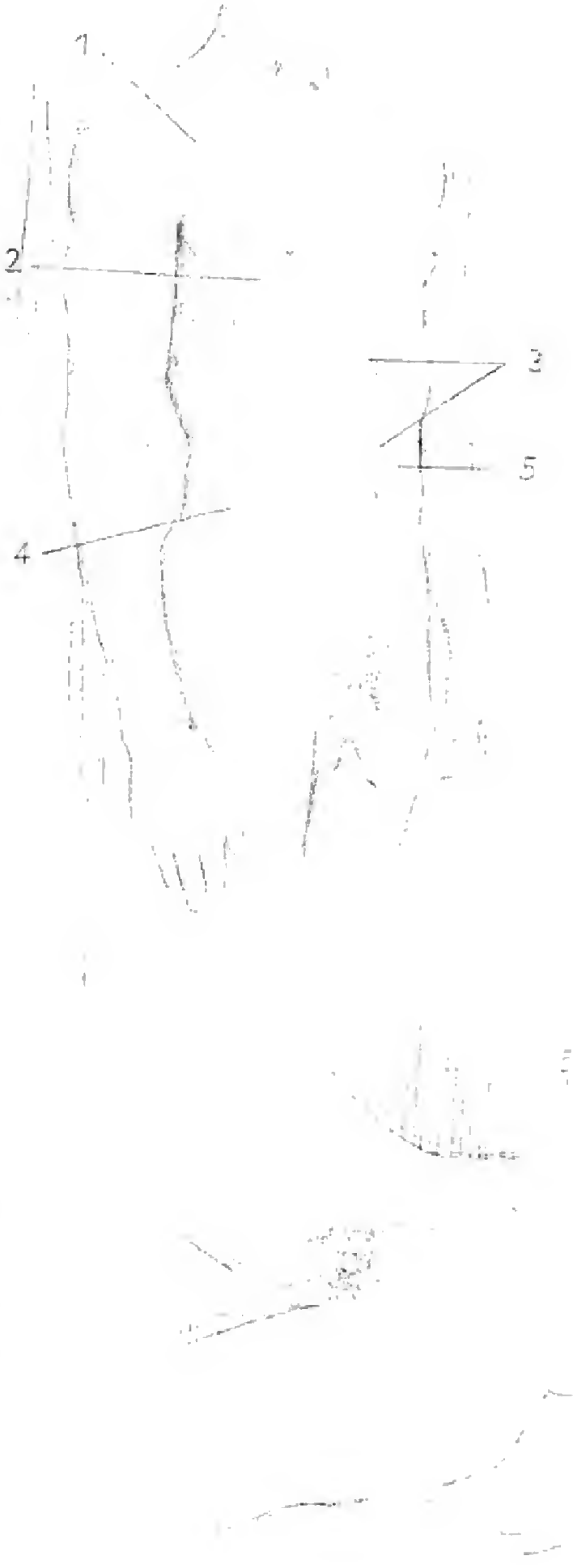
In the male, the fatty tissue is usually moderate and concentrated in certain areas (sub-mammary, above the iliac, gluteus, and above the pubic area). In the woman, fatty tissue is more abundant in the same areas (mainly the breasts), but also around the navel, in correspondence to the seventh cervical vertebrae. The distribution of hair is also different. In the male, the hair is diffused on the upper part of the thorax and, at times, on the back. The pubic hairs extend from the external genital organs across the navel, while the woman's are distributed horizontally. In the man, the arch of the ribs, which indicates a useful line of separation between the thorax and the abdomen, is sufficiently restricted, while rather ample in the woman. The masculine abdomen is creased vertically, from the central depression (dawn line) of the direct muscles. This region in the female has more delicate gradations caused by fatty tissue. The feminine thorax cage is shorter and more curved. The abdominal region appears more elongated proportionally than in the male. The navel is situated on the dawn line: in the man it is almost equidistant between the pubic area and the lower point of the sternum, whereas, in the woman, it is situated slightly higher and has a more vertical aspect.

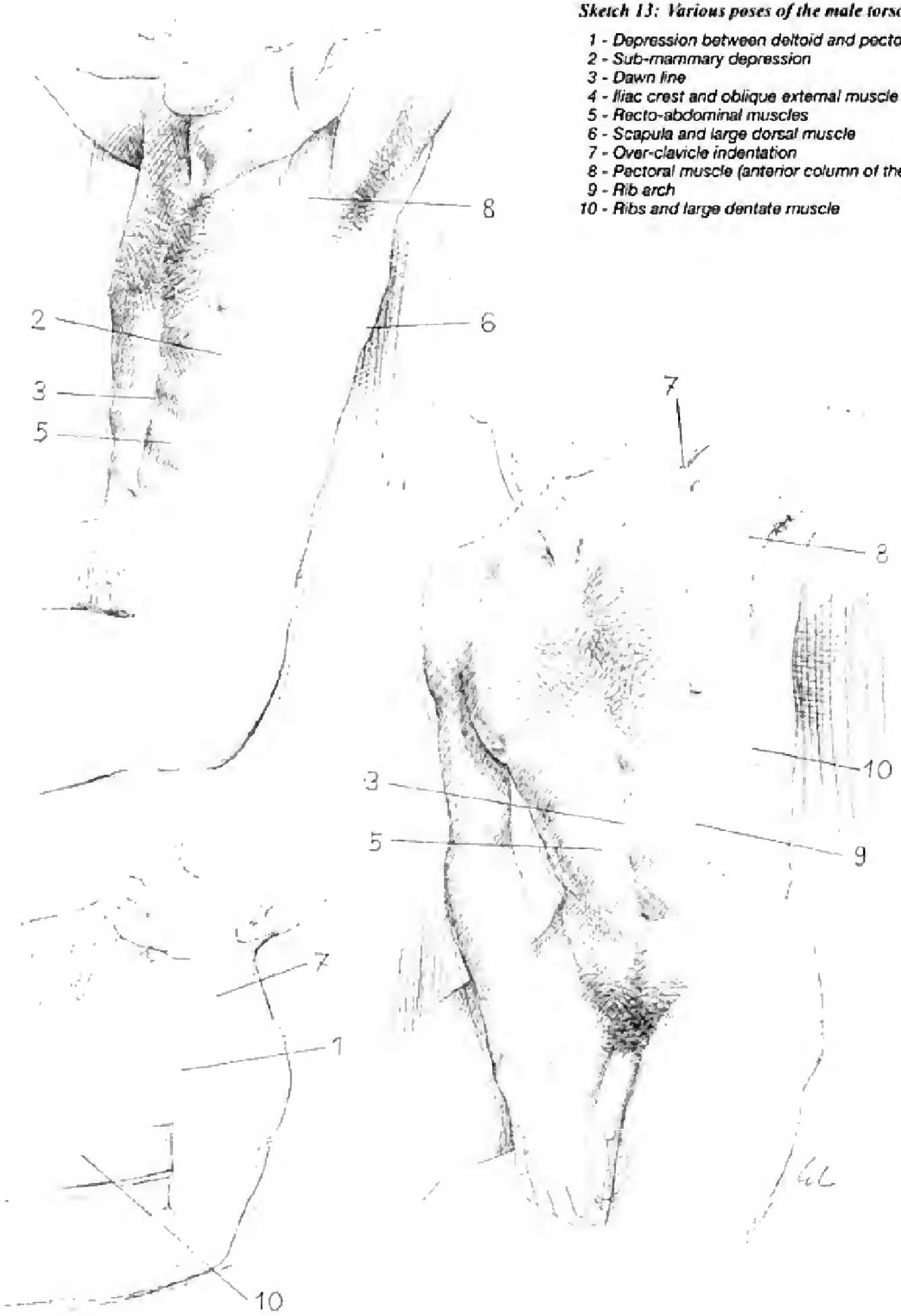
In drawing the trunk, it is necessary to pay attention to the correct positioning of the skeletal structure (the vertebral column, pelvis, scapula bond). The characteristic differential forms between the sexes depend on this, and other muscular and skin elements alone are too variable to be considered as a secure proportional reference.

Notes on Osteology

At the top of the trunk, segments of the appendages, or upper limbs, form a channel for the bones of the scapular belt. Likewise, those of the lower limbs form a path for the pelvic belt. For better morphological comprehension as to function, the skeleton of the trunk, relative articulations, and annexed muscles are subdivided into several sectors. The vertebral column, which is certainly the principle structure of the entire skeleton, runs through and sustains the entire trunk, uniting the articulator and muscular devices that surround it. The first of the sectors, pertaining to the cervical tract, is the neck. The second, pertaining to the thorax tract and cage, is the thorax. The third, pertaining to the lumbar tract, is the abdomen. The pelvis is included in the last sector because it is the means of bone attachment for the lower limbs (pelvic belt). It is considered pertinent to the trunk because it defines the lower part and represents the point of insertion for numerous muscles and ventral bands of the abdomen. An analogous consideration may be applied to the scapular bands (clavicle and scapula) from the functional point of view pertinent to the upper limb, but morphologically it is attributed to the trunk.

The vertebral column (see Functional Characters and Movements of the Vertebral Column. Appendices page 157) is an apparatus made up of short bones formed into columns on the median plane and united by joints and ligaments. The vertebral column is divided into sectors according to the morphological characters of the vertebrae: cervical vertebra (7), thorax (12), lumbar (5),





Sketch 13: Various poses of the male torso

1 - Depression between deltoid and pectoral
2 - Sub-mammary depression
3 - Dawn line
4 - Iliac crest and oblique external muscle
5 - Recto-abdominal muscles
6 - Scapula and large dorsal muscle
7 - Over-clavicle indentation
8 - Pectoral muscle (anterior column of the armpit)
9 - Rib arch
10 - Ribs and large dentate muscle

sacrum (5), and coccyx (3/4). The "free" vertebrae are the first 24, while the vertebral sacrum-coccyx elements are fused between them and practically immobile. The vertebral column in its entirety presents an almost cylindrical aspect, but when observed, the comprehensive volume of the vertebrae increases progressively from the cervical to the last lumbar, and then decreases.

The skeleton of the thorax is made up of twelve vertebrae of the thorax tract and twelve pairs of bones. The ribs articulate dorsally with the vertebrae and ventrally (except for the last two pairs) with an unequal median bone, the sternum, through cartilage. The comprehensive bone formed in this way is the thorax cage, also serving as the scapular band of the clavicle and of the scapula.

There are twelve pairs of ribs, curved bone plates, of which the first ten articulate (through cartilage and in different ways) with the sternum, while the last two flexible pairs are shorter and do not reconnect. Their positions are almost parallel at the connecting points. As a whole, they confer a cone-shaped or flattened-ovoid form at the thorax cage. The form is largely open at the upper and lower extremities. In the lower, the axis (in an individual in the erect position) is obliquely direct downward and forward.

The anterior face of the thorax cage shows the sternum, rib cartilage, and ribs that run across the sides.

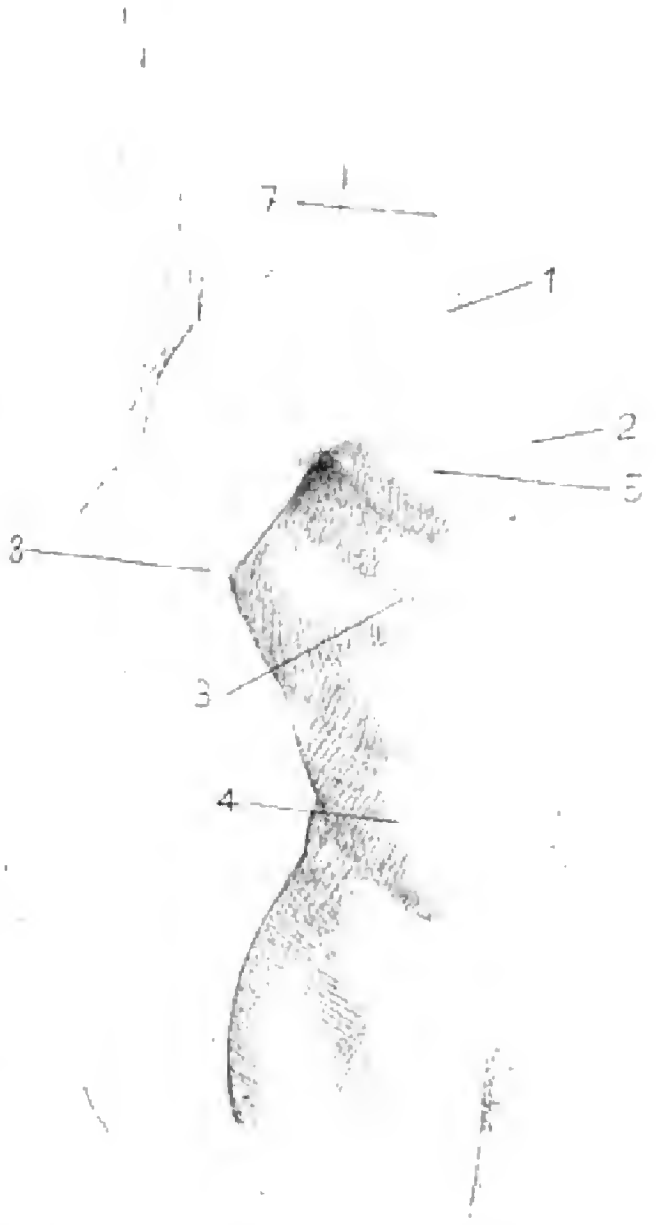
The side faces reveal the maximum height of the cage and the typical ovoid aspect. They also show the ribs, in an oblique direction across the lower part, regularly parallel and with spaced interval between them. The posterior face presents the thorax tract of the vertebral column. The ribs depart from the oblique direction across the lower part.

The general form of the thorax cage is variable in relation to respiratory movements and an individual's constitution. The aspects are readily seen in normal life and, because the bone structure is in large measure just under the skin, easily palpable. However, the bones of the thorax cage distinguish themselves in a downward direction by their diameter relationships and the form of the lower opening. Stretched and elongated thorax cages are of the long linear type; short and wide cages the short linear type. Cages of intermediate forms also depend on induced individual character, and develop from the muscular masses or pathological alterations.

The sternum is a median flattened bone, positioned anterior to the thorax cage, onto which the ribs connect. It is made up of three segments: the handle, or upper portion; the body, flattened and elongated; and the xiphoid process, a somewhat pointed lower segment. Whether the handle forms an angle with the body, the complex inclination of the sternum depends on individual characteristics; above all, on sexual dimorphism—a female's sternum inclination is minor compared to that of a male.

The clavicle is an elongated, flattened bone, slightly undulated in the shape of an S. Its major axis is quasi-horizontal. It articulates itself with the sternum and with the acromion of the scapula and is positioned on the an-terior face of the thorax cage.

The scapula is a bone plate with three recognizable forms that are morphologically interesting to the artist. The triangular blade has two faces, one pressing against the ribs and the other, dorsal, having at least the medial margins and the lower point perceivable on the surface. The spine, a large bonev structure, is transversally projected on the dorsal face and is articulated at its terminal part (acromion) with the clavicle. The coracoid process is another prominent bone that projects directly forward from the upper margin and marks the origin of the brachial biceps muscle. The glenoid cavity is situated laterally on the border of the scapula and articulates with the head of the humerus. The scapula bone is situated on the inner posterior portion of the thorax cage with the vertebral margin parallel to the vertebral column (in the anatomic position) and the median height extending from the third to the seventh rib. The scapula and the clavicle undergo relevant displacement in relation to the movement of the upper limb.

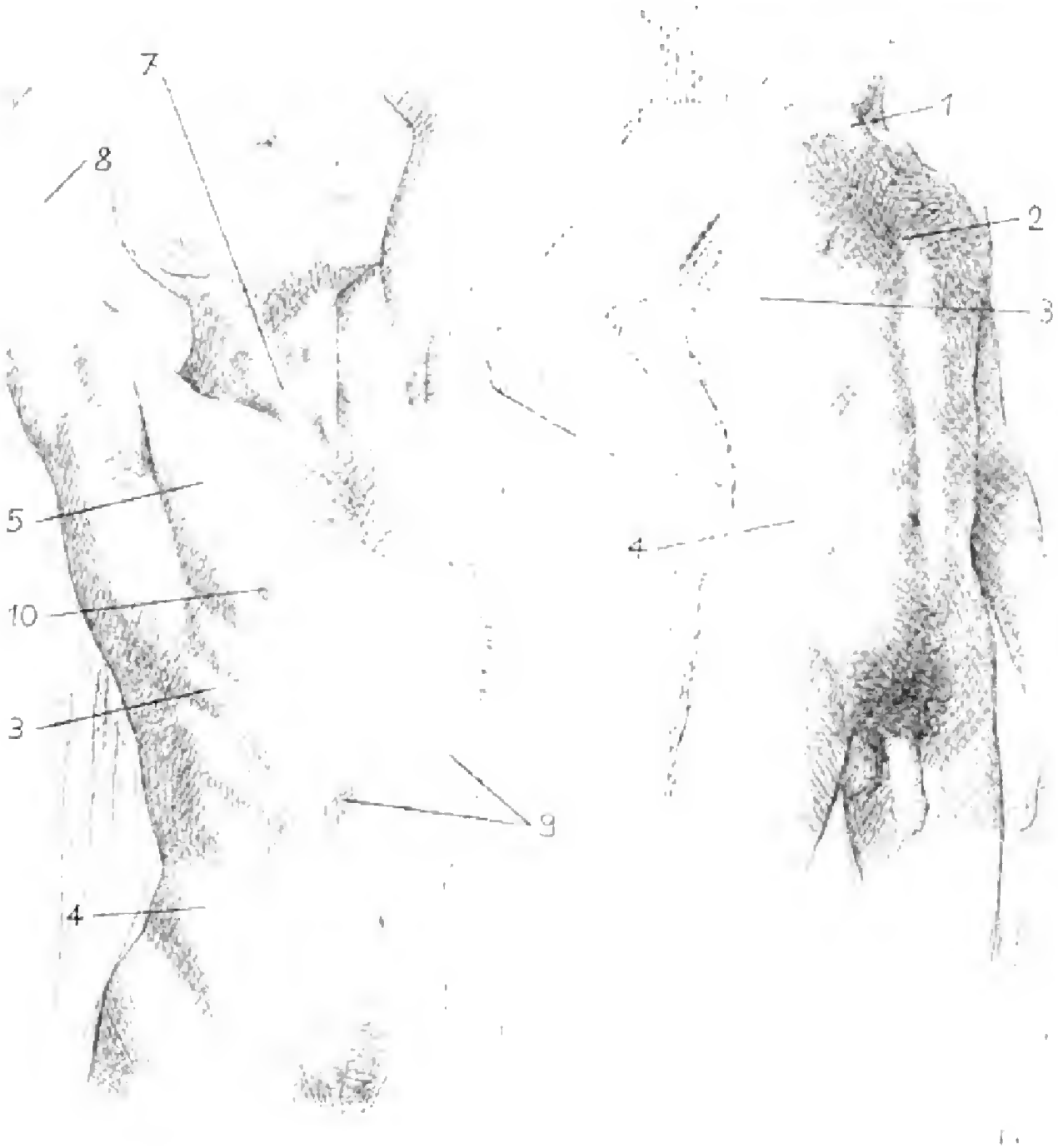


The pelvis is a strong, basin-shaped bone formed by the conjunction of two complex bones. The hipbone articulates forwards in a direct mode and backwards through the interposition of the sacrum bone. The resulting structure has remarkable stability, permitting the most delicate of joint movement in the presence of numerous robust ligaments.

The hipbone is a large flattened bone of varying degrees of depth, but on average rather subtle. It is made up of the union of three sections: the ileum, the hip joint, and the pubes.

Sketch 14: Various poses of the male trunk

1 - Clavicle (and sternum-cleido-mastoid muscle)
2 - Sternum
3 - Ribs and large dentate muscle
4 - Oblique external muscle
5 - Large pectoral muscle
6 - Biceps, coracobrachial, large dorsal
7 - Sternum-cleido-mastoid
8 - Biceps
9 - Rib arch
10 - Slight upward displacement of the nipple during elevation of the arms



The ileum is the largest section and it is made up, in part, of layers. The blade, the most restricted part, is the body that contributes to the formation of the acetabolum (the seat of the articulation with the femur). The iliac crest is the upper border of the blade. It starts initially with the anterior iliac blade and ends with the upper posterior iliac blade.

The hip joint, the post-inferior part of the hip bone, consists of a section that confines the ileum in the acetobolum and a branch that unites with the lower section of the pubes, outlining a quasi-round obstructed opening.

The pubes is made up of bone that, when fused with the hip joint and ileum, forms the acetabolum cavity, one of the strengthened descending branches that descend from the hip joint. The two pubic branches meet on a median plane and form an articulation, the pubic symphysis.

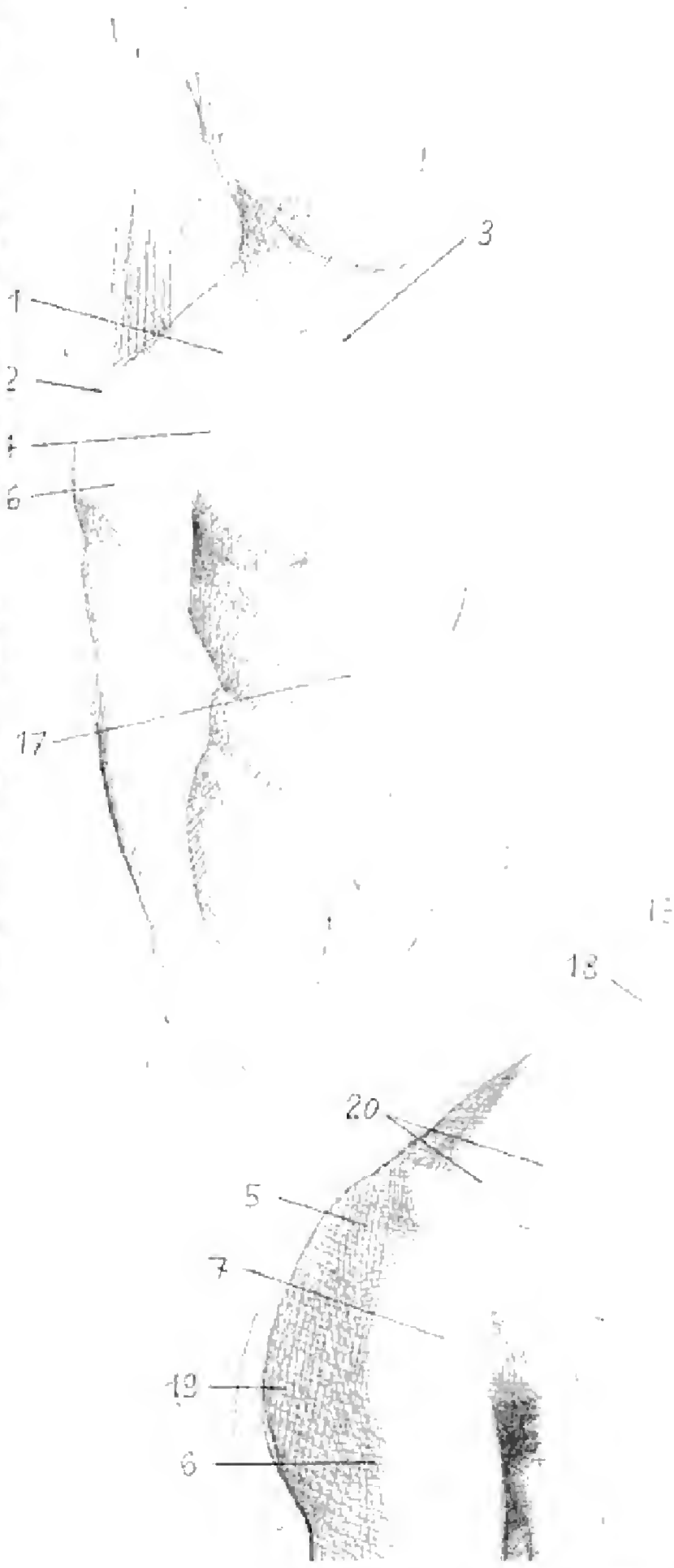
The pelvis is a bone structure very characteristic to medical practice, and to anthropological or racial research. It is the part of the skeleton presenting the most relevant sexual differences. Compared to the male, in the female the iliac ditches are larger and more outwardly inclined. The obstructed openings are triangular (or oval), and theinclination of the complex is greater; it is, on the whole, shorter and wider in size.

Notes on Arthrology

The articulations between the elements that constitute the bone structure of the trunk allow, in general, little possibility of movement. The mechanics of a joint is largely realized in allowing for small, partial movements.

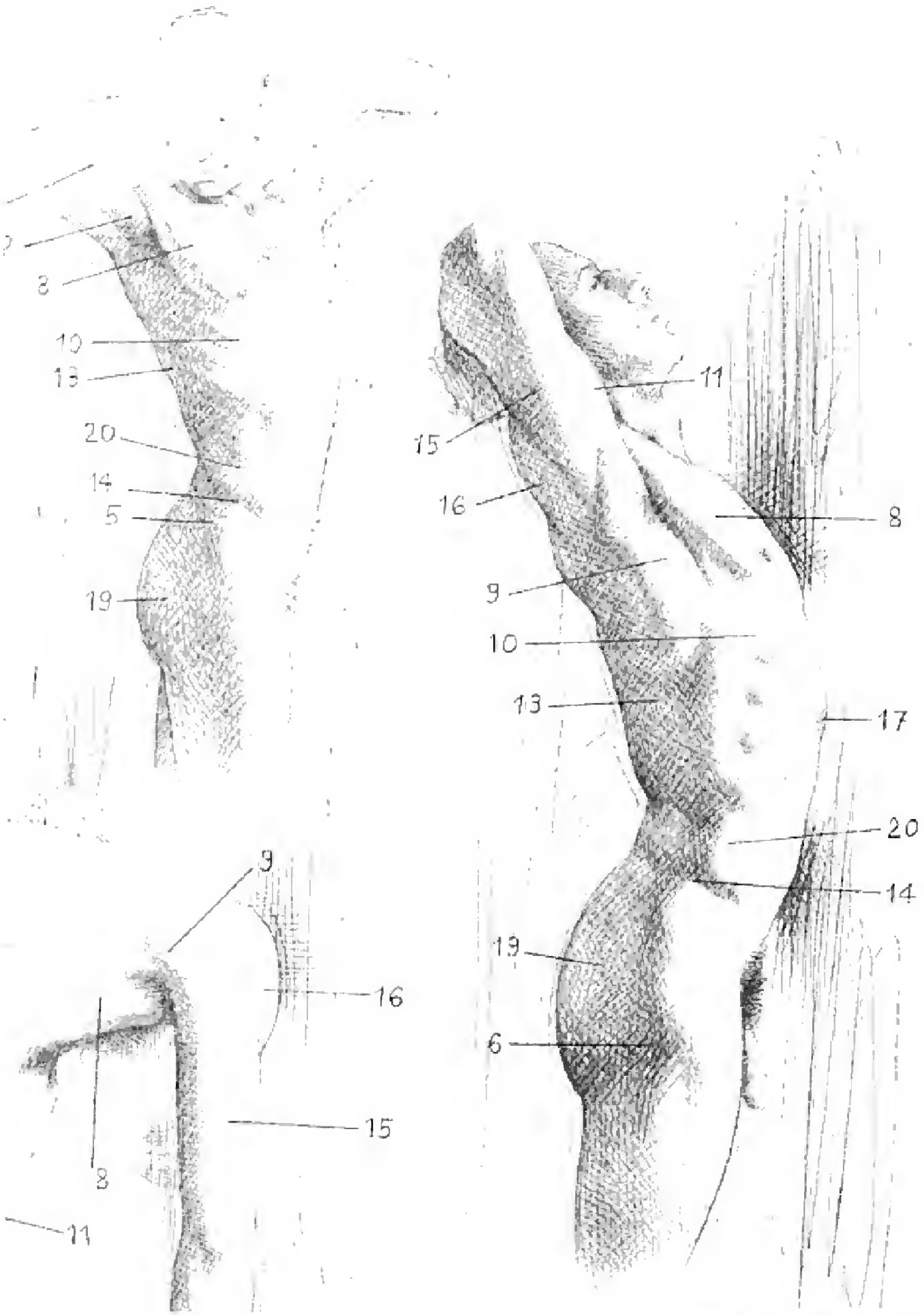
The vertebrae (as you will see more clearly later) are united for half the joint and reinforced by numerous strong ligaments. The ligaments come together at the mass of the column in a remarkably robust joint with mobility and elasticity.

The joints can be divided into two functional groups: synarthrosis, the joints between the vertebral bodies; and diarthrosis, the joints between the joint processes. At this point, the joints that have certain characteristics become joined with the cranium (upper occipital, upper-ondontoid vertebral-cranium, etc.). The skeletal



Sketch 15: Flexion, extension, and rotation in the male trunk

1 - Clavicle and scapular belt
2 - Acromion
3 - Jugular indentation
4 - Deltoid-pectoral track
5 - Gluteus medius and iliac crest
6 - Large trochanter
7 - Tensor of the wide fascia
8 - Large pectoral
9 - Large round
10 - Large dentate
11 - Brachial biceps
12 - Coraco-bracchiale
13 - Large dorsal
14 - Crease of external oblique muscle
15 - Triceps
16 - Deltoid
17 - Rib arch
18 - Large dentate
19 - Gluteus maximus
20 - Oblique extern



elements of the thorax cage, the ribs, and the sternum are articulated between them and with the vertebral column by means of the rib-vertebral joints and the rib-sternum. The joints of the scapular belt (the acromio-clavicle, sternum-clavicle, and above all the scapula-humerus that will be retained in relation to the limb) provide movements to the upper limb in respect to the skeletal axis.

The fundamental joint of the pelvis is the hip, which interacts with the femur. It is this articulation of the hip that, for functional reasons, indicates dealings with the lower limb.

The joints of the pelvis are, instead, almost immobile, or have only very reduced movements. There are two: the sacrum-iliac and the pubic symphysis.

Notes on Myology

For a more useful description of the form of the external trunk (often defined as "torso"), it is convenient to include also the axo-appendicular muscles, which form connections between the axis and the appendix muscle sections, corresponding to the scapular belt (for the upper limbs) and the pelvic girdle (for the lower limbs). The rachis musculature is formed by the equal and symmetrically aligned muscular systems along the vertebral column, from the cranium to the coccyx. They are divided into two groups: the spinal muscles (or the vertebral tubes) and the ventral musculature of the rachis. All of these muscles are positioned around the vertebral column.

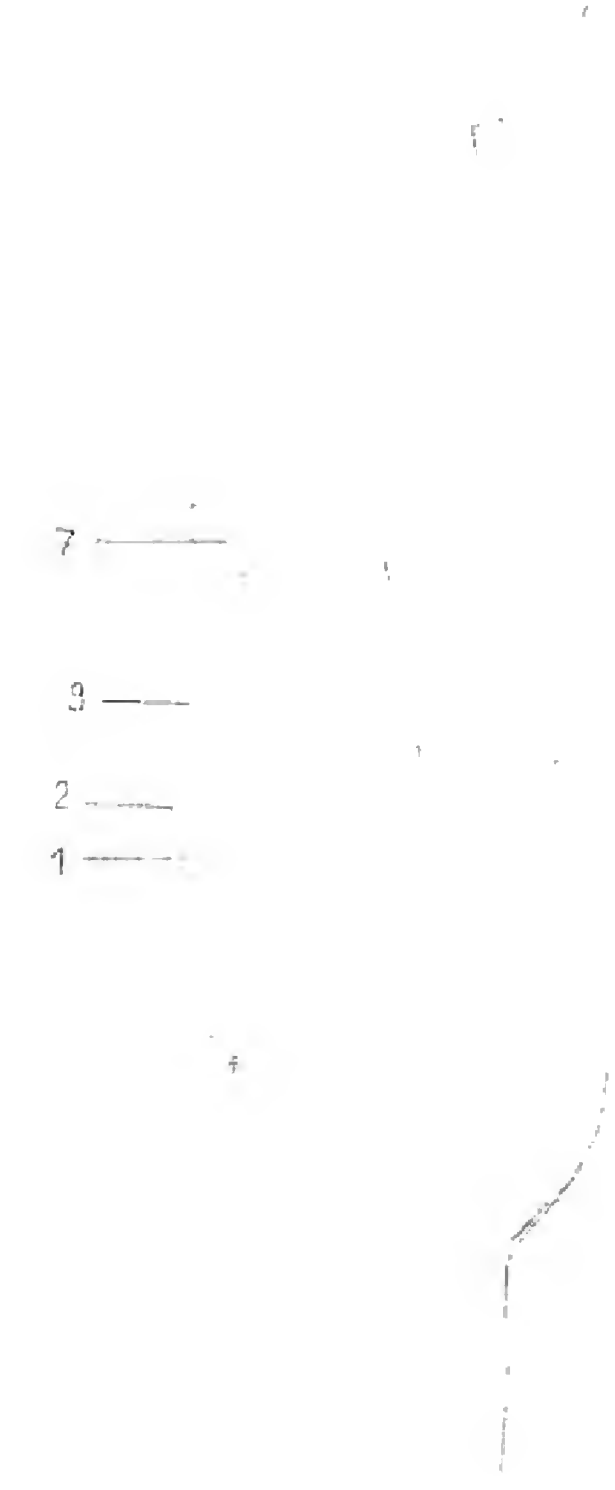
The musculature of the neck is complex and divided into several groups: the lateral musculature (or paravertebral) made up of scalene muscles and covered by platysma; the sternum-cleido-mastoid muscle; the muscles of the hyoid-bone region (suprahyoid and sub-hyoid). Some muscles (sub-occipitals, splenius, recto) are considered in the musculature of the rachis, while the trapezium muscle determines the external morphology of the nape of the neck.

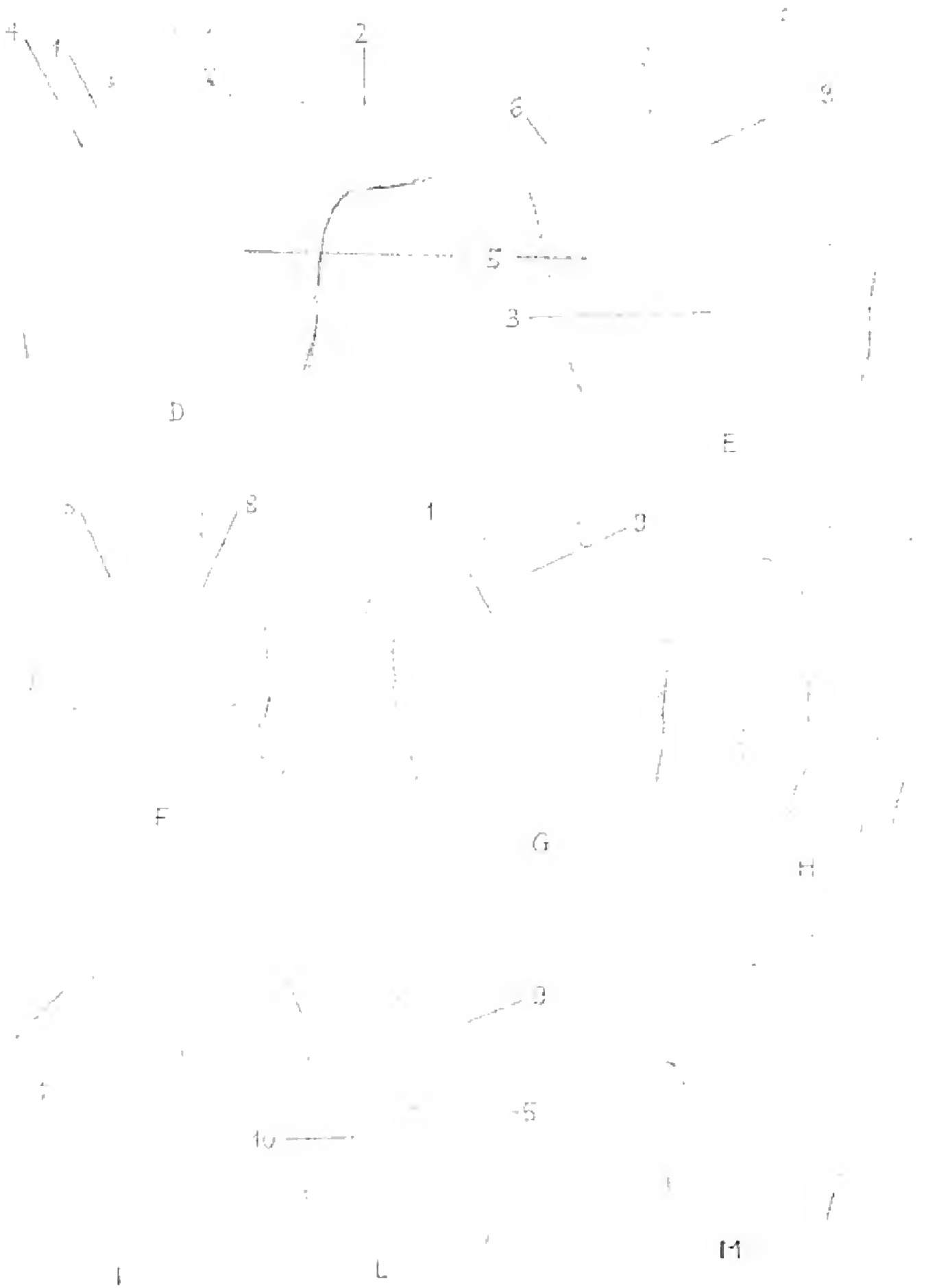
The musculature of the thorax consists mainly of intrinsic muscles, or organic muscles that intrude on the bone elements of the thorax cage and of the vertebral column. They also exercise their prevalent action on the respiratory mechanism. Such muscles are further grouped in two systems: the muscles of the inter-rib spaces (inter-rib, rib elevators, transversals of the thorax) and the spinal-rib muscles (posterior, lower and upper dentate). The diaphragm muscles join at these muscles as well.

Still, the gross axo-appendicular muscles divided in two groups determine the external morphology of the thorax and the back: thorax-appendicular (large and small pectoral, sub-clavian, anterior dentate) and spinal-appendicular (trapezium, large dorsal, rhomboid, elevator of the scapula). Together with these, the deltoids, over- and sub-spinal, sub-scapular, and large and small rounds are considered the shoulder muscles.

The musculature of the abdomen is made up of large muscles: quadrates of the loins, recto-abdominal, internal and external oblique, and transversal (to which the muscles of the perineum join themselves).

The musculature of the pelvis and of the hip is made up of the group of spinal-appendicular muscles (minor psoas, ileo-psoas) and of muscles of the buttocks (gluteus maximus and medius, internal obturator, twins, quadrates of the femur, and tensor of the broad fascia)





Morphology of the Armpit

(sketches 26–27)

The armpit region appears as a depression situated between the upper part of the thorax lateral inner portion and the upper median part of the brachial. If the limb is adherent to the trunk, the armpit cavity is reduced in an anterior-posterior sense, at a deep direct crevice. If the arm is in abduction, or separate from the trunk until rejoining the horizontal position, the armpit appears in its maximum depth. It results in a dome form or trunk pyramid, in which the apex (bottom of the armpit) corresponds to the median covering of the coracoid process and leads across the base of the neck.

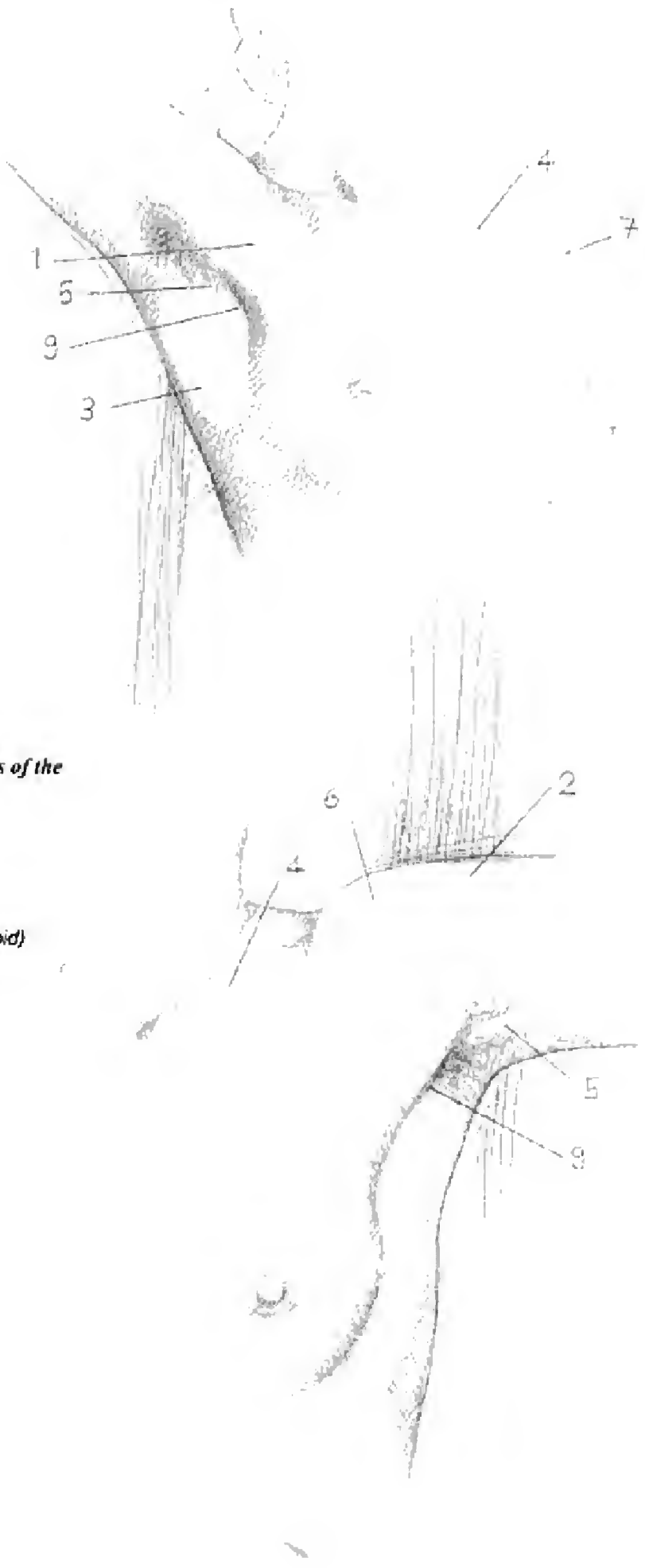
The armpit hollow opens forward and laterally, defined by two muscular points, sheltered by the armpit portion of the superficial covering. The almost laminate anterior covering constitutes the anterior inner portion (or anterior pillar). It is formed by the large and small pectorals. The posterior covering, deeper and more ample in extension, constitutes the inner portion. It is formed by the large dorsal and the large round. It is useful to remember that, when designing or modeling a nude, when horizontally extended, the arm's anterior inner portion is brief, protruding, and oblique. As one looks forward, the entire armpit cavity is visible, while it is impossible to observe it dorsally.

The median inner portion of the armpit cavity is represented by the upper inner portion of the lateral thorax, or from the first four or five ribs covered by the anterior dentate. The lateral inner portion is reduced at a margin defined by the humerus and proximal tracts of the coraco-brachial and the edge of the biceps.

The armpit skin, particularly that of the bottom of the cavity, is rich in sweat glands, lymph nodes, and fatty tissue. The morphology of the armpit changes radically if the arm, because of abduction or rotation, is brought up vertically. In this position, the cavity flattens and reveals at times the projection of the humerus head.

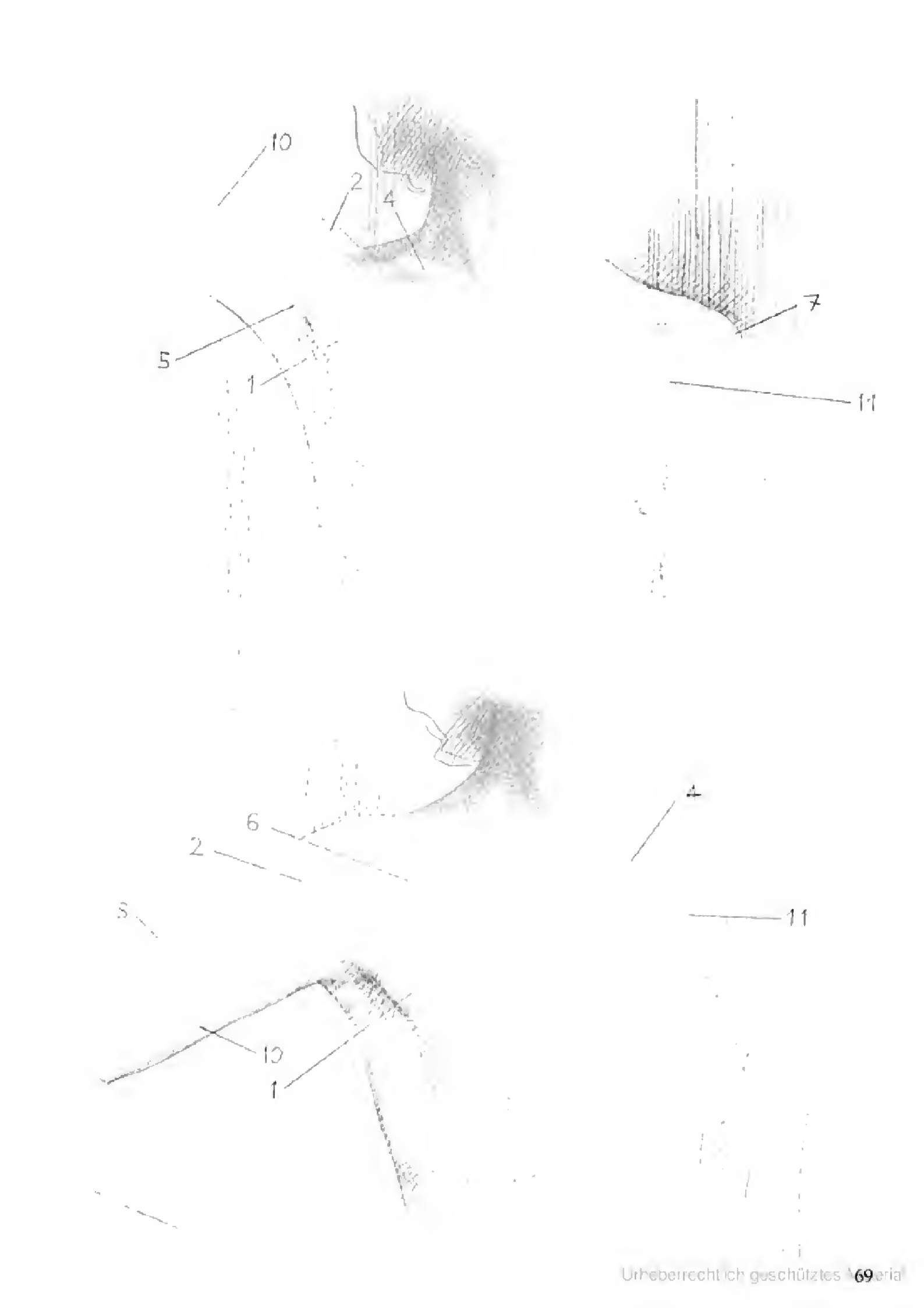
Sketch 26: Some morphological aspects of the armpit in the male

1 - Deltoid
2 - Large pectoral (forms the pillar and anterior inner portion of the armpit)
3 - Biceps
4 - Coraco-brachial
5 - Large round
6 - Triceps: medium head
7 - Triceps: long head
8 - Virtual cavity of the armpit
9 - Large dentate
10 - Large dorsal
11 - Inner portion and posterior pillar of armpit (formed by large round and large dorsal)
12 - Armpit cavity



Sketch 27: Some morphological aspects of the armpit in the female

1 - Anterior pillar (large pectoral)
2 - Deltoid
3 - Posterior pillar (large dorsal)
4 - Clavicle
5 - Coraco-brachial
6 - Humerus head (covered by the deltoid)
7 - Acromion
8 - Brachial
9 - Armpit cavity
10 - Biceps
11 - Deltoid sulcus



Morphology of the Thorax

(sketch 28)

The thorax corresponds to the upper portion of the trunk, positioned between the neck and the abdomen. Its bone structure is made up of thorax sectors of the rachis (the vertebral column, muscular structure, and annexed ligaments) and of the thorax cage, on which the complex structure of the scapular belt (clavicle and scapula) rests. The thorax provides a point-of-contact surface at the ribs, the pectoral muscles, and the sternum. In the woman, the development of the breasts is relevant.

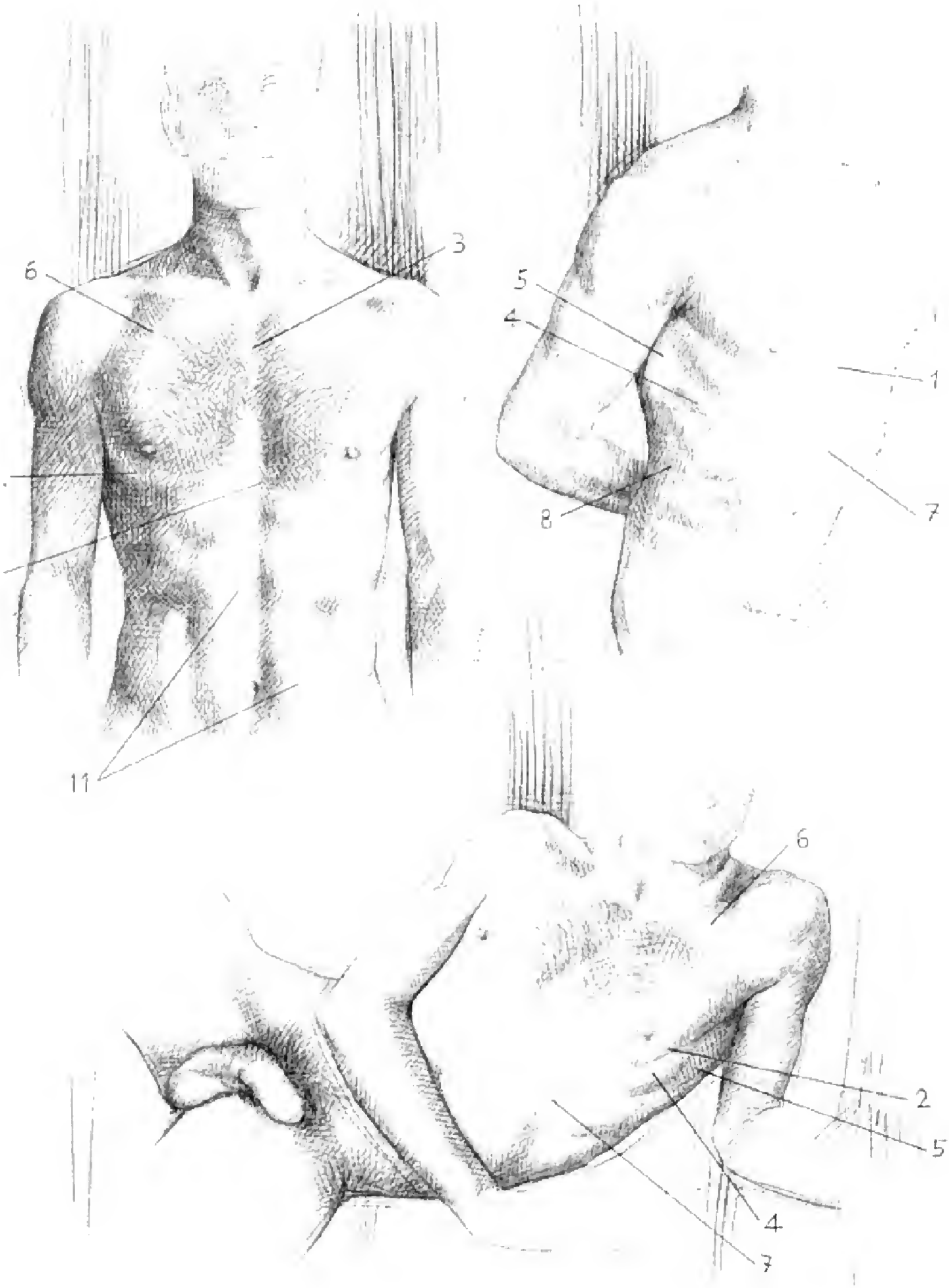
The posterior face, which runs longitudinally through the center of the rachis, shades the region of the back (see sketches 12 and 37). The two distinctly curvilinear lateral faces extend from the armpit hollow to the base of the thorax cage.

The complex form of the thorax is approximately trunk-conic, rather flattened in an anterior-posterior sense. The restricted upper opening communicates across the neck. The lower, more ample opening is bent across the abdomen. The form and dimension of the thorax registers normal individual variations connected with constitutional factors. In every case, however, the height of the thorax is always larger than the transversal diameter and still greater of the anterior-posterior.

In long-lined individuals, the thorax is stretched and long, with the ribs posted in a strong oblique manner and with acute rib angles. At the extreme opposite, in brachial-type individuals, the thorax is short and wide, while the ribs are less inclined and the rib angle more obtuse.

Sketch 28: Aspects of the male trunk

1 - Epigastrium depression in correspondence to the xiphoid process
2 - Lower margin of the large pectoral muscle, attenuated by a small fatty deposit
3 - Sternum angle, between the handle and body of the sternum
4 - Last four digits of the large dentate (from the sixth to the ninth rib)
5 - Large dorsal
6 - Clavicle portion of the large pectoral
7 - Rib arch, formed by the lower margin of the thorax cage
8 - Fluctuant ribs not bound at the sternum (eleventh and twelfth rib)
9 - Nipple, projected on the fifth rib or the fourth inter-rib space
10 - Cephalic vein
11 - Straight abdominal



Morphology of the Female Breasts

(sketches 29–31)

The breasts are organs of the integument apparatus, equally and symmetrically situated in the pectoral region. They are characteristic of the mammiferous class and contain skin glands, which in the female are particularly developed for the secretion of milk destined for the nutriment of offspring in the first months of life.

The breast is a protruding body at which there is a projection at the apex, the nipple, circled by a small skin area with particular characteristics, the areola. It is made up of about twenty bunched glandular lobes, in which excretory ducts converge across the nipple where they lead to the extern. The glandular lobes have variable volume according to the functional phase. They are wrapped in fatty tissue. The quantity contributes to determining the form, volume, and consistency of the breast. They allow the displacement of the mammary body in respect to the profound plane. The breast rests without strict adhesion to the superficial covering which covers the anterior face of the pectoral muscle.

The breasts are initially situated on the thorax, occupying an area that extends from the lateral margin of the sternum at the anterior pillar of the armpit (at times following across the lateral inner portion of the thorax) and from the third to the seventh rib. The base of the mammary rests, in large measure, on the large pectoral and in part on the anterior dentate and upper margins of the large oblique and recto-abdominal.

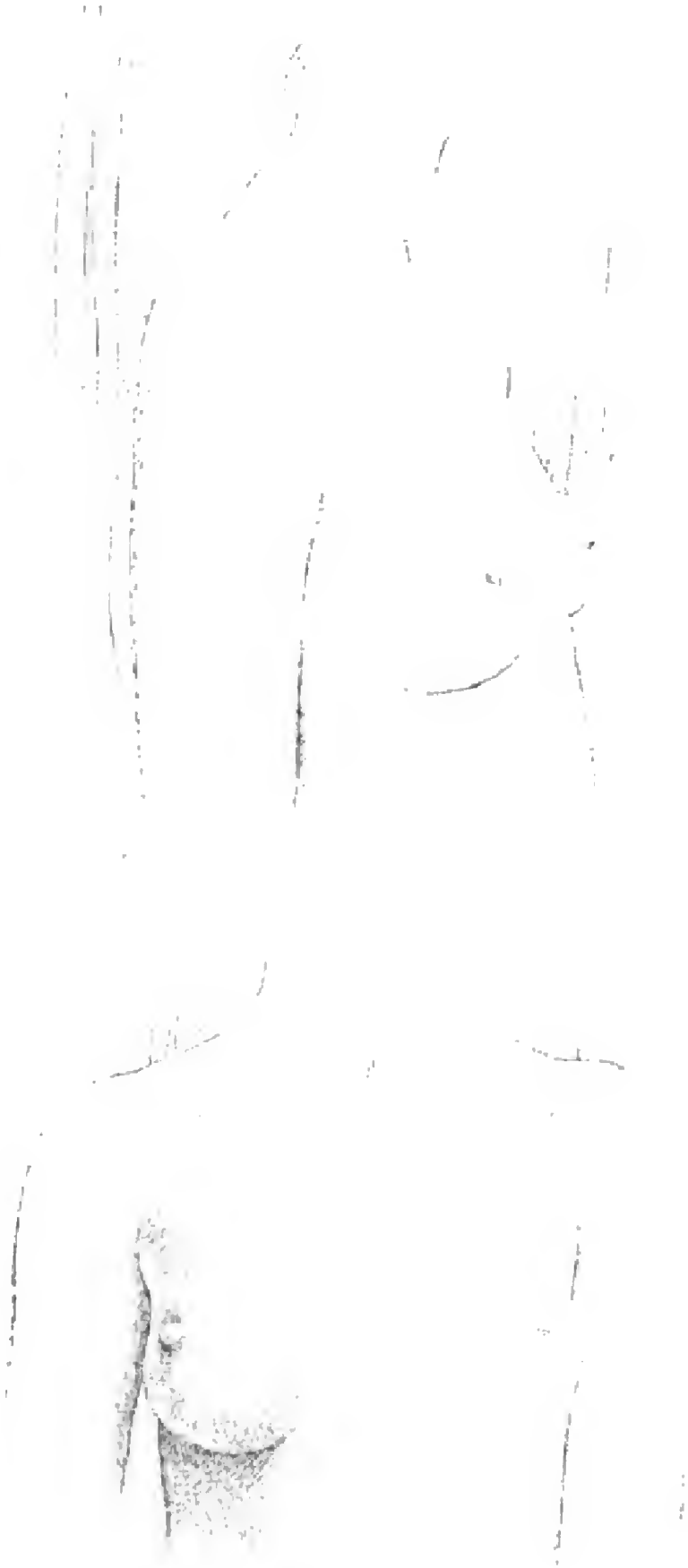
The two breasts are situated along the median line of the sternum region of the chest, a hollow more or less ample and profound in relation to their volume and to the individual morphological characteristics of the thorax cage on which they are placed. Some mammary bodies have shaded confines across the inner portion of the thorax, but in the adult woman it is almost always delineated by a more distinct limit (sub-mammary crease) between the lower margin of the breast and the skin underneath the inner portion of the thorax.

The volume of the breasts has no relationship to the functional capacity of the glands but depends almost solely on the accumulation of fat, which has relation to the total quantity of fat distributed on the body. For example, it is common to encounter thin women who are carriers of voluminous breasts, or large women with rather small breasts.

The form of the female breasts is also various, depending on individual character, age, and physiological conditions. Variations may also be dependent in part on racial characteristics. For example, some dark-skinned populations have demonstrated elongated breasts with a restricted implanted base, while Nordic or Asian populations tend to less protruding breasts with a wider base. In women generally, however, the two breasts almost never have exactly symmetrical form and dimensions.

In the anatomic position of the body, the breasts have a conic or semicircular form, slightly widened transversally with the lower half more curved (because of the effect of gravitational force) in respect to the upper half that is shaded almost evenly.

The areola, a circular skin zone of various diameters (from 2 to 7 centimeters) and intense pigmentation (from rosy to dark), is found at the apex of the breast. Sparse, subtle wrinkles, small projections, and se-



baceous openings are found on its surface. In some instances, the areola may be absent, in which case it is slightly raised and curved, and even more rarely circled by some random hairs.

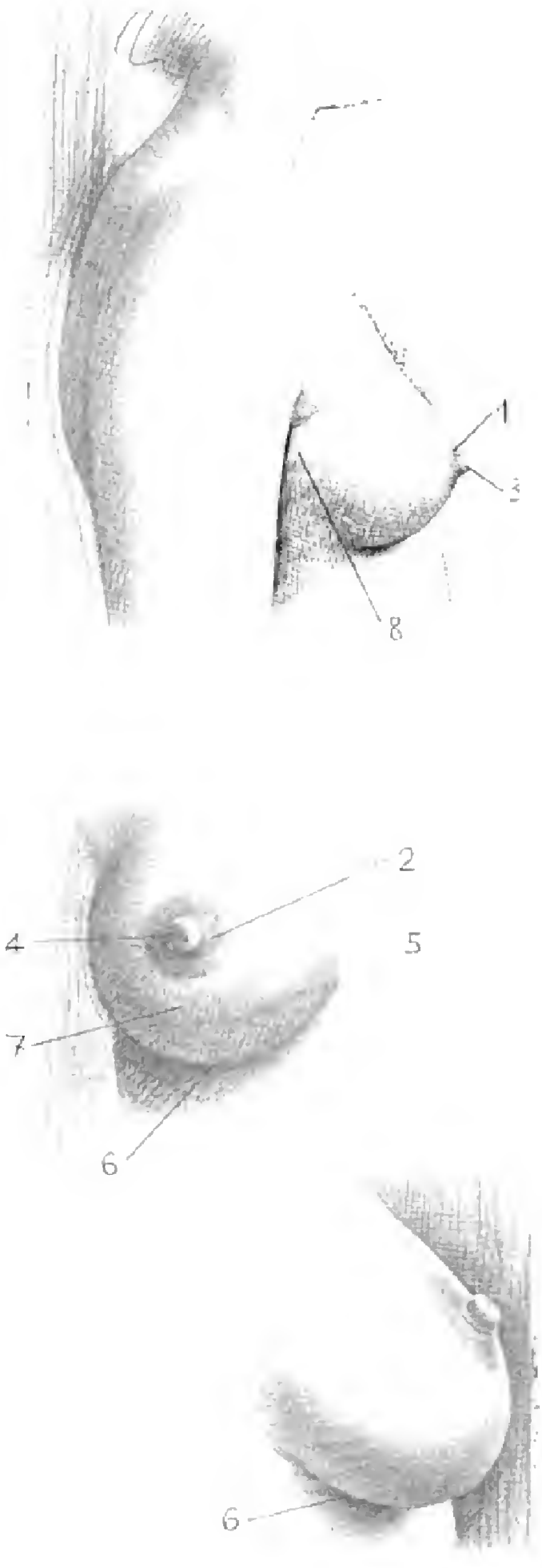
The nipple is situated almost in the center of the areola. The nipple is a cone- or cylindrical-shaped projection close to one centimeter wide and tall that presents a more wrinkled and intensely pigmented area than the areola. The varieties of the form and dimensions of the nipple range from a scarcely indicated contour or a hollow to a noticeable protrusion. The apex of the nipple normally appears clearer in color and more wrinkled on the surface (the sieve area contains about twenty milk-duct openings).

The skin that covers the areola and the nipple also endures modifications that allow for the effect of the contractions of smooth musculature fascicles contained. For example, emotional states, variations in temperature, or friction can promote such changes as shriveling, hardening, elongation. At times, the skin may turn pale.

The nipple is projected, with large approximation and considering a mammary conformation indirectly developed on the fourth rib or fifth inter-rib space. Its position is directly forward, slightly upward, and somewhat lateral. The mammary body is placed on the convexity of the thorax cage. Observing the female thorax at three-quarters view, the nearer breast appears frontally, while the further is placed almost in profile.

The movements of the shoulders and arms, and the force of gravity, in relation to diverse corporal gestures, modify the external morphology of the breast. For example, when the arm is lifted, the breast becomes more semicircular, the sub-mammary crease attenuates, and the areola appears more vertically elliptical. During the anterior flexion of the trunk, the breasts become pendulous and their lower face separates from the inner portion of the thorax. Only with direct and attentive observation can the artist study the variable tipology and morphology of this part of the body.

The skin that covers the breast is very elastic, and therefore adapts to the modifications in form and volume of the organ. It is also very subtle, leaving visible sub-skin venous reticules.



Sketches 29–31: Morphological aspects of the female breasts

1 - Areola
2 - Montgomery tubercle
3 - Nipple
4 - Sieve area of the nipple
5 - Chest
6 - Sub-mammary crease
7 - Mammary body (right breast)
8 - Lateral expansion (armpit) of the mammary body
9 - Effects of gravitational force on the form of the breast

The male breast is normally reduced at the rudimentary state. It is more minimally raised and consists almost exclusively of the nipple. Its position on the thorax is less mobile, in respect to that of the female nipple. It is projected on the fifth rib or fourth inter-rib space. The masculine nipple is very small and posted horizontally or slightly oblique towards the armpit at the center of a less extensive, circular or elliptical areola. It is situated on the lower border of the large pectorals, rather separated laterally in correspondence to a limited and subtle fatty deposit.

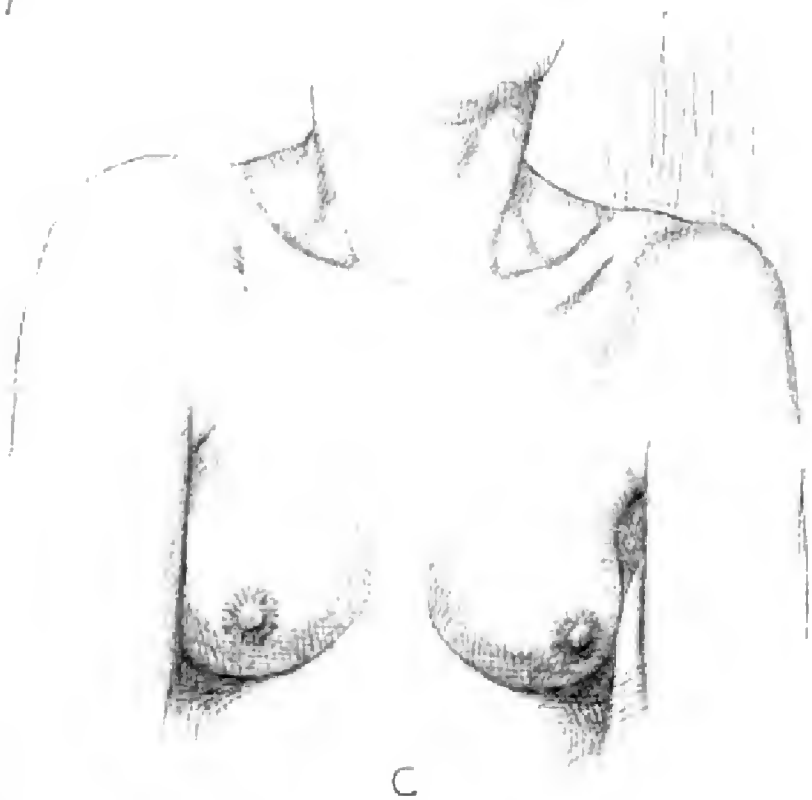
The male nipple, like the female but in minor measure, endures displacement from the effects of movement of the limbs and modifications from the effects of temperature, emotional, and mechanical influx.

In the anatomic position, the nipple of the male is normally situated on the oblique line that conjoins the acromion and the navel.

Sketch 31: Morphological aspects of the female breasts

1 - Effects on the breasts of extension and abduction of the shoulders
A - anatomic position
B - extension/abduction of the shoulders
C - abduction of the shoulders
2 - It is normal for the breasts to be asymmetrical in form and position on a subject

A



C

B

Morphology of the Abdomen and Side

(sketches 32–33)

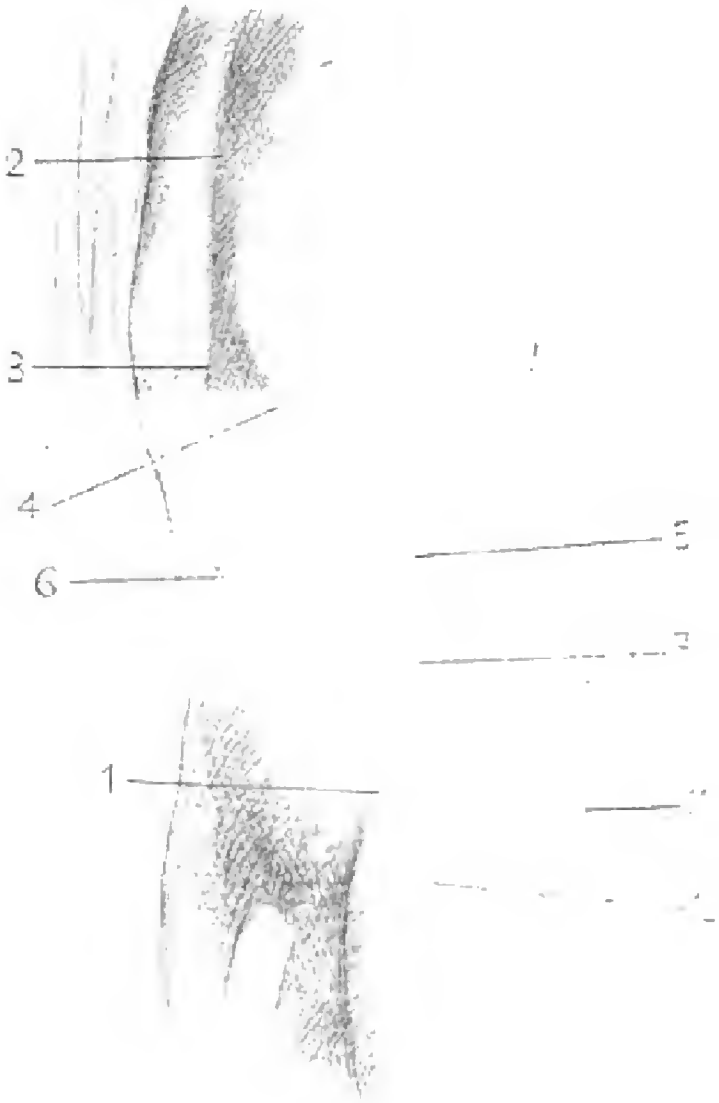
The abdomen is the portion of the trunk posted between the thorax and the pelvis. It is made up of the inner portions that circumscribe the ample cavity containing the viscera. Only the lumbar tract of the vertebral column forms the skeletal support of the abdomen. The inner portion (made up of tendon wrappings and thin muscular plates that are more robust in the posterior region and more subtle and extensive in the lateral and anterior regions) takes access upwardly on the inner portion of the thorax (sternum and rib margins) and below on the contour of the pelvis.

This region of the body does not anteriorly present many morphological surface references other than the navel and the median crease. It is constituted by a slight stretched skin depression, which extends from the sternum to the navel (and at times in athletic individuals almost to the limit of the pubes). Corresponding to the "dawn line," the increased sub-skin tendon joins and keeps the two straight abdominal muscles distinct. In athletic male models, it is easy to observe a pair of transversal depressions corresponding to the inscription tendons of some straight muscles.

The external form of the abdomen is slightly different between the sexes. In the man it is normally similar to a flattened cylinder in an anterior-posterior sense. In the woman, given that the major width is of the pelvis, the trunk is cone-shaped with a wide lower base. The feminine abdomen appears more rounded and longer in proportion to the masculine with a longer distance between the navel and the external genital organ.

In the male the fatty deposit is more abundant in the region above the navel. In the female the fatty tissue accumulates prevalently below the navel.

The height of the front of the abdomen corresponds to the distance between the sternum xiphoid process and the upper margin of the pubic symphysis. The height of the posterior corresponds to the height of the lumbar tract of the vertebral column. The curvature of the lumbar column, more accentuated in the woman, and its relationship with the inclination of the pelvis influences the form and position of the abdomen.



Sketch 32 Formation of the abdomen and the side

1 - Inguinal line
2 - Xiphoid process of the sternum
3 - Median line (dawn line) longitudinally posted between the two straight muscles of the abdomen
4 - Rib arch
5 - External oblique muscle
6 - Navel
7 - Iliac line and iliac crest
8 - Fatty deposit around the navel
9 - Semicircular abdominal crease
10 - Large trochanter of the femur and sub-trochanter fatty deposit
11 - Gluteus maximus
12 - Tensor of the broad fascia

The dimensions of the abdomen, above all the transversal and anterior-posterior, are individually varied in relation to the bio-typological, physiological, and pathological characteristics. They also vary according to sex and age.

The height is more stable, however. Normally, in an adult, the abdomen is equivalent to about a quarter of total body height, or two times the length of the head. From birth to its first year, however, an infant's abdomen represents nearly a third of the total body height. It is voluminous in relation to that of an adult, but gradually, after the growth of the various other body parts, it conforms to typical adult proportions.

The form of the abdomen has a strict relationship to the morphological constitution of the subject. All the possibilities are noted, from the flattened abdomen of a long-lined individual to the globular more projected abdomen of a short-lined subject.

The sub-umbilical portion of the abdomen may be crossed, especially in women, by a weak semicircular crease that conjoins the anterior margins of the iliac bone. It is considered an accessory of the crease of principal flexion placed transversally at the abdomen above the navel.

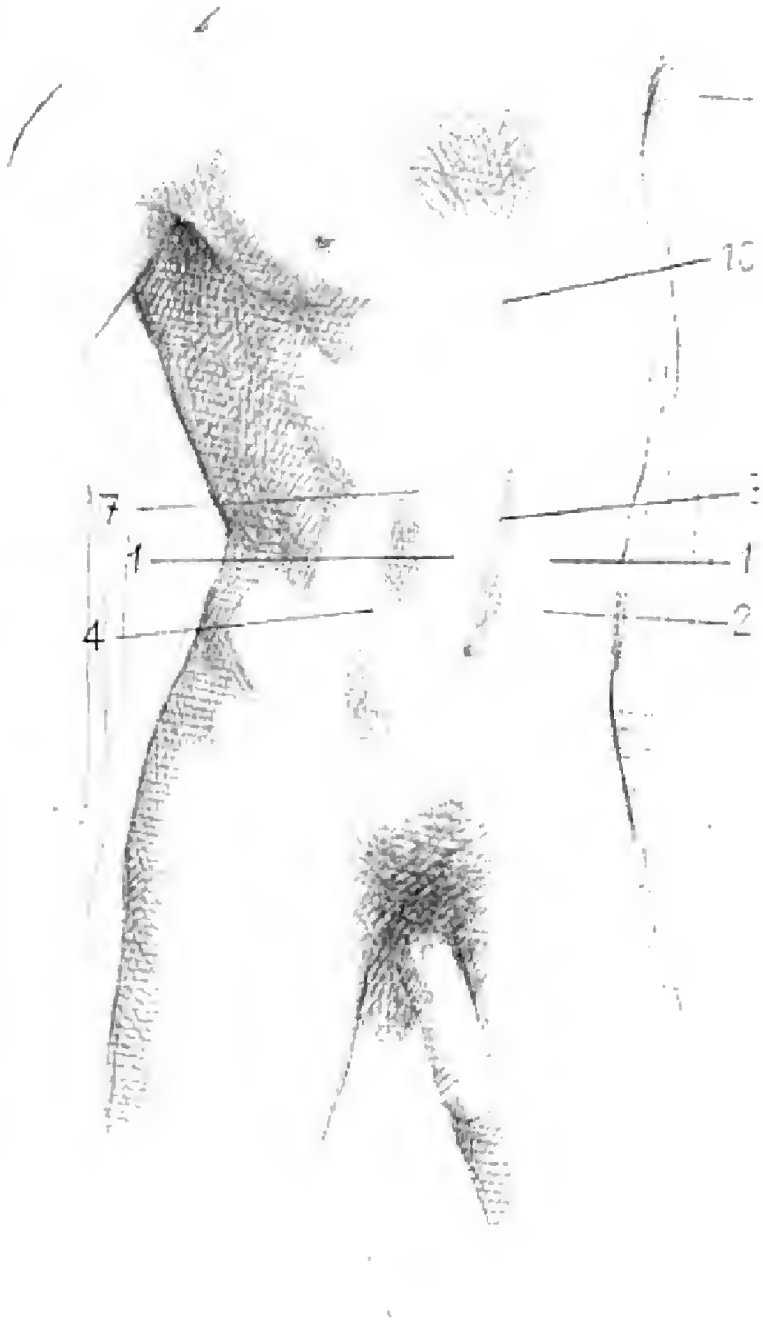
The supra-pubic crease is shorter, but more marked. It is concave, and shaded across the inguinal crease that defines the upper confines of the pubic region.

This area is rich in body hair deposits in both sexes (see page 40). Corresponding to the pubic symphysis, it is prominent because it is seated on a well-localized deposit of fatty tissue (mound of Venus, in women, and penile in men).

The lateral limits of the abdomen shade in the sides, while the posterior limits confine the sacrum and lumbar regions). The side extends from the lateral inner portion of the trunk to the lower border of the thorax cage at the pelvis, where it rejoins the hip region.

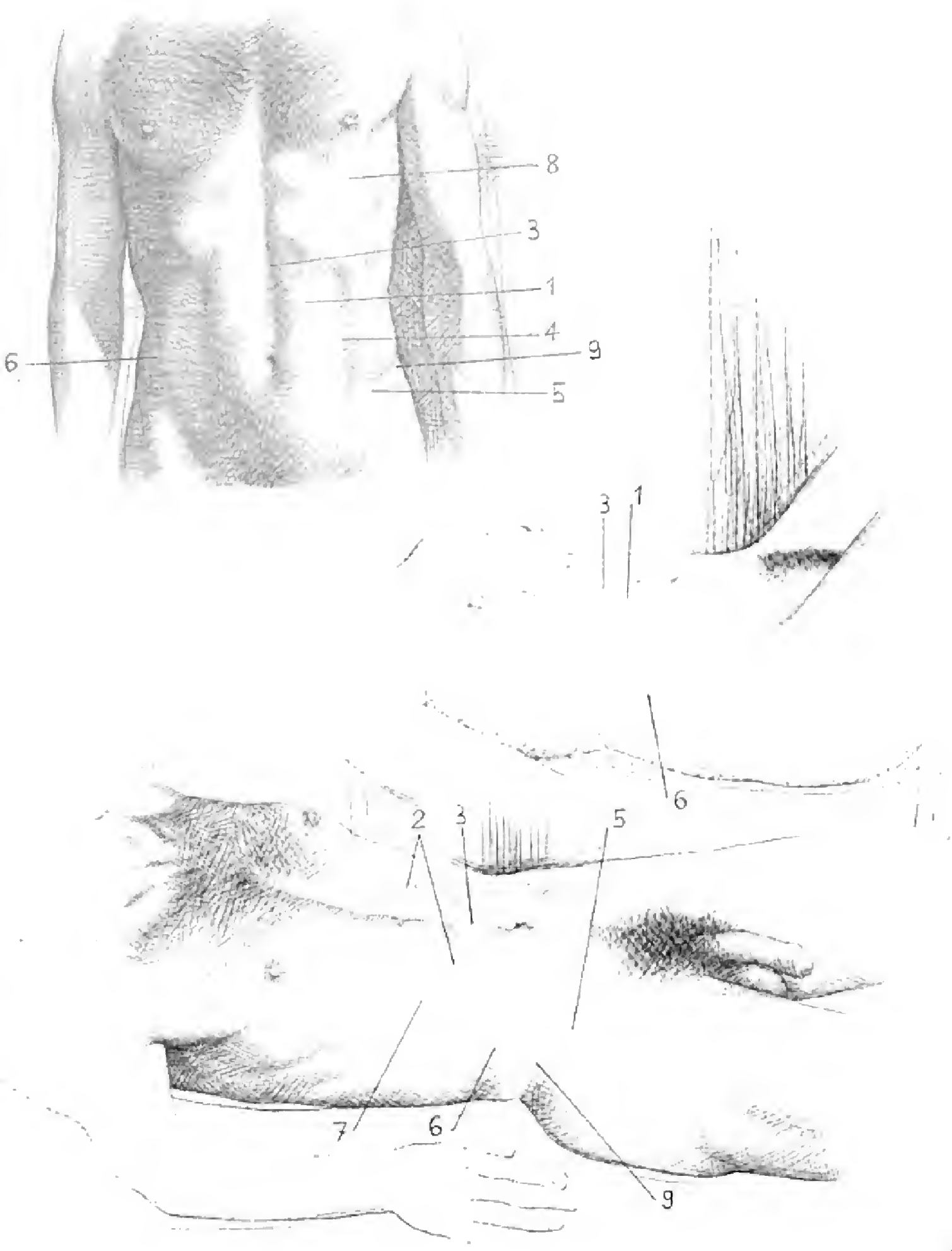
Remember that, given the different dimensions of the thorax cage in the two sexes, the distance between the lower margin of the thorax cage and the iliac crest is larger in the woman than in the man.

The upper limit of the side is indicated by the crossing of the large dentate and oblique external muscles.



Sketch 33: Aspects of the straight muscles of the abdomen in the male and female

1 - Rect-abdominal muscles
2 - Inscription tendon of the straight abdomen muscle
3 - Longitudinal median depression corresponding to the "dawn line"
4 - Lateral limit of the recto-abdomen muscle
5 - Upper anterior iliac spine
6 - Oblique external muscle
7 - Rib margin (arch)
8 - Sixth rib
9 - Iliac crest



The anterior confines are dated by the projection of the oblique external muscle in proximity to the abdominal aponeurosis. In the posterior the side is contiguous to the lumbar region.

From a morphological point of view the lower limit is more interesting because it constitutes a characteristic wrinkle, the iliac crease. This does not correspond to the iliac crest, but in part covers a slight convexity of the lower portion. It is present for the effect of certain muscles that are inserted on the external border of the crest (large and small oblique, abdominal transversal), for the variable quantity of fatty tissue. In a man of normal conformation the iliac crease is easily noticeable. It is even more noticeable in those engaging in athletic activity. In the woman, however, it is less marked, due to fatty tissue that typically extends into the hip region.

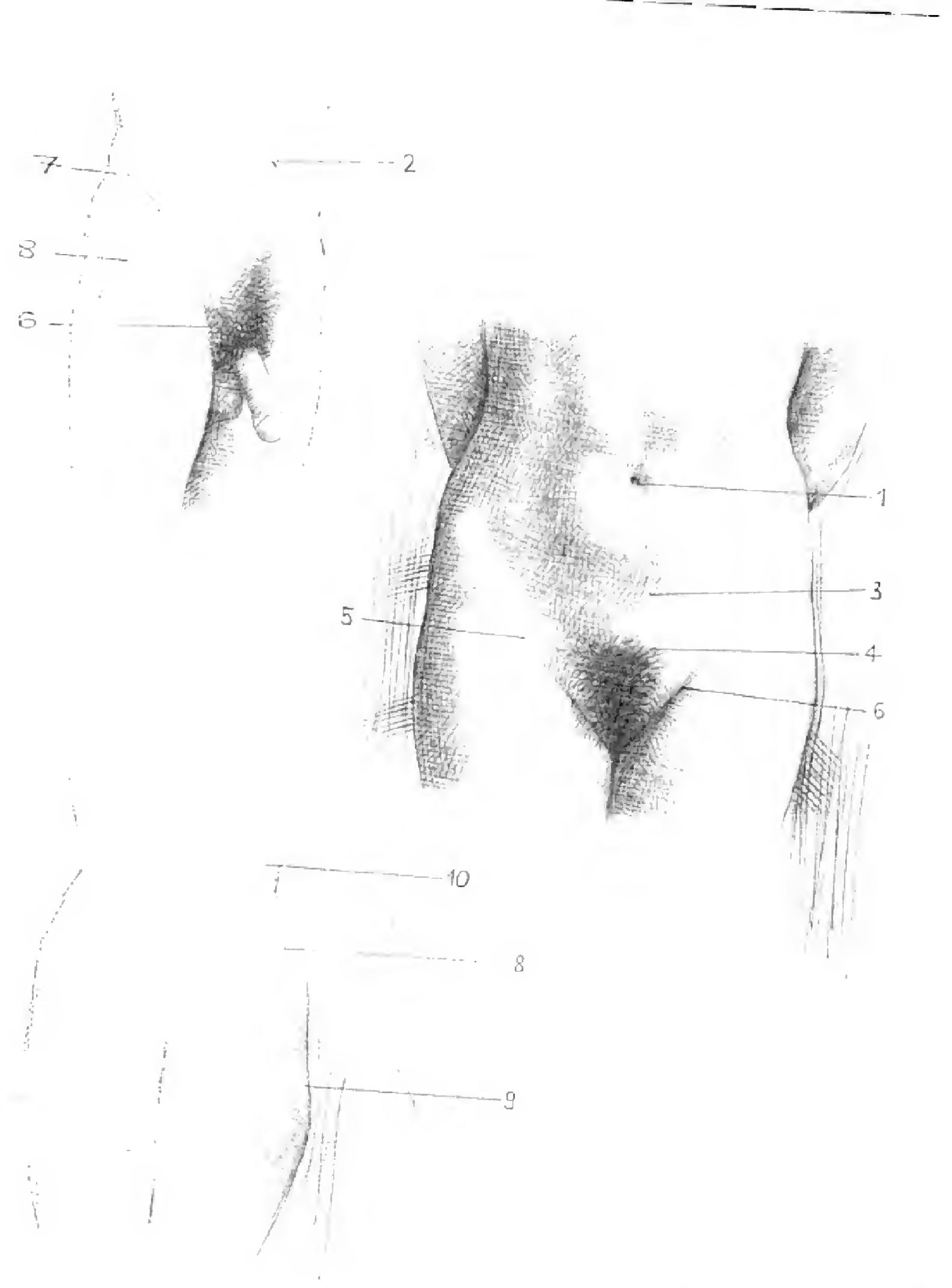
The navel is a skin depression seen at the cicatrix. It is formed after birth, from the cutting of the umbilical cord, which connects the fetus and the placenta in the uterus. It is situated on the median plane of the inner portion of the abdomen in the crease of the dawn line. It corresponds to the point in which it crosses with the lower inscription tendon of the straight abdomenal muscles. The navel is placed almost equidistantly from the pubes and the xiphoid process. In the man it is slightly closer to the pubes, while it is situated higher on the woman. In the erect position, the position of the navel is projected on the disc between the third and fourth lumbar vertebrae.

The external form is varied, depending on individual characteristics, corporal movements, and the quantity of surrounding fatty tissue. Normally it appears as a depression about one centimeter round, and rather deep. It can also be horizontally elliptical, or vertically elliptical, especially in women and thin individuals.

A distinct skin crease, the umbilical border, defines the upper part of the navel. It shades into the surrounding sides of the umbilical crease. The skin projects in an irregular superficial eminence.

***Sketch 34** Aspects of the side and navel in the male and female*

1 - Navel
2 - Umbilical border
3 - Semicircular crease of the abdomen
4 - Supra-pubic wrinkle
5 - Femur dimple
6 - Inguinal wrinkle
7 - Crease of the hip (iliac line)
8 - Gluteus medius muscle
9 - Large trochanter
10 - Oblique external



Morphology of the External Genitals

(sketches 34-35)

In both sexes, some parts of the genital apparatus are situated on the superficial portion of the anterior perineum. They are located at the lower extremity of the abdomen and are in certain measure externally visible; therefore, they have much interest for artists' purposes.

Man - The external masculine genital organs are the testicles and the penis. The testicles, two sexual glands that produce sperm, are paired in a quasisymmetrical position near the median plane. They have a slightly flattened transversally ovoid form and are contained in the scrotum, a skin sac where the left testicle is generally situated slightly lower than the right. The scrotum is covered in strongly pigmented skin and presents individual diversity in size and form in relationship to age and physiological situation. Its dimensions can contract (through muscular components contained in the inner portion) under emotional or temperature influences. The skin of the scrotum is creased with transversal wrinkles originating from a vertical cordon projection. It proceeds across the root of the sac and is strewn with random hairs that thicken across the pubic area.

The penis is the erectile masculine organ. It serves as the junction and path of the urethra, which conducts urine to the external. In a state of repose, it is situated on the anterior face of the scrotum. In this state, the median length of the penis is around ten centimeters.

The form, consistency, direction, volume, and dimension of the penis vary considerably according to whether it is in a flaccid or erect state. The erect state depends on the filling and stagnation of blood in the internal organs of the penis. The cavernous body, accompanied by a rich vascular deposit, augments the dimension of the penis to about a third larger and wider.

The penis, covered with hairless and pigmented skin, has a quasicylindrical form, except for the terminal portion. The terminal portion is enlarged, conical, and covers almost the entire prepuce. Part of the gland is uncovered, leaving visible the somewhat decentralized opening of the urinary canal. While the skin of the gland has a rosy color, the color of the prepuce is more pigmented. It is also very elastic and able to glide along the gland, permitting the uncovering of the terminus only partially at times. Certain populations, for religious or hygienic reasons, practice circumcision. This consists of surgically removing the entire prepuce, which leaves the gland permanently exposed.

Woman - The feminine genital organs are situated near the anterior area of the perineum and are made up the vulva, an unequal median projection of ovoid form, in which the canals of the uterus and the vagina are opened. The vulva starts initially with a rounded projection, the mound of Venus. It is formed (as seen) by an often-fatty layer situated at the level of the upper border of the pubic symphysis. It continues with two large skin folds, the outer lips, which are normally near the median plane. Descending, they converge to the seam at the center of the perineum, about one centimeter from the anal opening, laterally defined by a distinct crease of separation on the internal face of either leg.

The skin area of the mound of Venus and the lateral skin of the outer lips are generally densely covered with dark, undulating hair. Remember the diverse positions of the hair in the two sexes. In the woman, the hair terminates almost distinctly, with a transversal line posted slightly above the pubic symphysis. It extends to the median face of the leg. In the man, the hair continues, even if more randomly, along the median line almost to the navel and onto the root of the leg.

Below the outer lips of the female genitals, two other folds of various dimensions are found (the inner lips). The inner lips are fine, hairless, and rose colored, intensely at times. The inner lips protect the vestibule of the vagina and the urinary canal. Their margins are free and irregular, at times projecting past the outer lips.

Anteriorly, the inner lips conjoin in a complex way at a small erectile organ (the clitoris), homologous to the male penis yet very reduced in size. The median face of the inner lip gradually runs through the vestibule of the vagina, restricting the presence of the hymen, a fine partially incomplete membrane of variable form.

Morphology of the Buttocks

(sketch 36)

The gluteus muscles (minimus, medius, maximus) form the buttocks; uniting at the hip. The gluteus region is positioned laterally and posteriorly at the pelvis. It extends to the surface of the iliac crest, the confines of the lumbar region and the side (see page 80) at the transversal gluteus crease, which inferiorly defines the buttock.

The hip and the buttock are not distinctly separated. The term "hip" refers to the upper part of the lateral surface of the region. The term "buttock" refers to the fleshy protrusion situated posteriorly.

The external surface of the buttock is strongly curved (more in front than back) by the presence of the gluteus maximus muscle and by an adipose deposit. The adipose deposits are of various consistencies and more abundant in women. The gluteus crease is made up of a fibrous septum of the superficial fascia. It firmly attaches to the ischium tuberosity, forming a pocket-shaped skin fold of fat deposits. The median tract of the gluteus crease is therefore very distinct. It gradually shades across the lateral portion where, in some cases and above all in men, it parts into two slight quasi-parallel grooves. The gluteus crease, obviously, appears more or less accentuated in relation to the movement of the leg in respect to the trunk. For example, it delineates more distinctly during extension and tends to disappear during flexion.

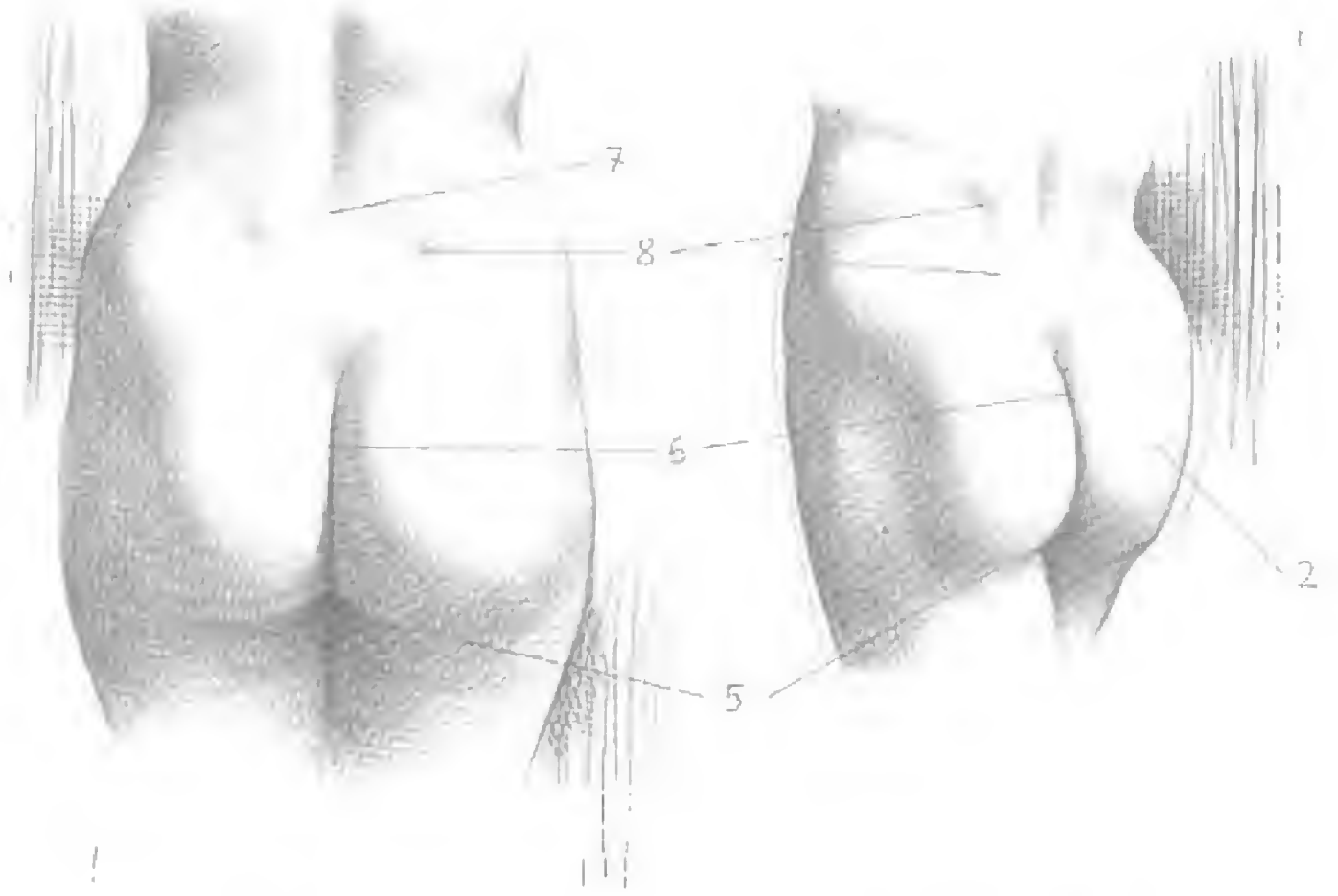
The buttocks of the two antimeres are separate, in a lower portion of a deep sulcus positioned vertically on the median plane of symmetry. They initiate in correspondence to the coccyx and extend to the perineum.

The sacrum region is rather flat. It posteriorly separates the two buttocks in the upper portion along the two lines that conjoin the sulcus with the two lumbar dimples, which laterally correspond to the upper posterior iliac spine. Transversally, there is more distance between them in women, which causes the greater width of the woman's pelvis.

The curvature and projection of the buttocks is particular to the human species, due to erect posture and mobilization. The adipose panniculus has sexual characteristics of localization and quantity. In the woman, it is more abundant and evenly distributed, resulting in the region's regular, rounded form which extends onto the sides of the legs. In the man, the buttock is more globular, of minor volume and less rich in fatty tissue. It presents a lateral depression in proximity to the large trochanter of the femur (more accentuated in athletic individuals) at the aponeurosis of insertion of the gluteus maximus. This depression is easily visible in the erect position, yet disappears during flexion of the leg.

Sketch 36: Formation of the buttocks in the man and woman

1 - Gluteus medius
2 - Gluteus maximus
3 - Oblique extern
4 - Large trochanter
5 - Gluteus crease
6 - Intergluteus sulcus
7 - Median lumbar dimples
8 - Lateral lumbar dimples
9 - Retro-trochanter depression
10 - Tensor of the broad fascia



Morphology of the Back

(sketches 37–39)

In common language, the entire posterior surface of the trunk is called the back (or backbone). It is made up of bones and muscles positioned in such as way as to sustain the body in an erect position and protect the internal organs. The muscular system is complex. Overall it is revealed by the trapezium. In the upper portion it is revealed by the dorsal muscles and in the lower portion by the intermediate tract and the gluteus muscles.

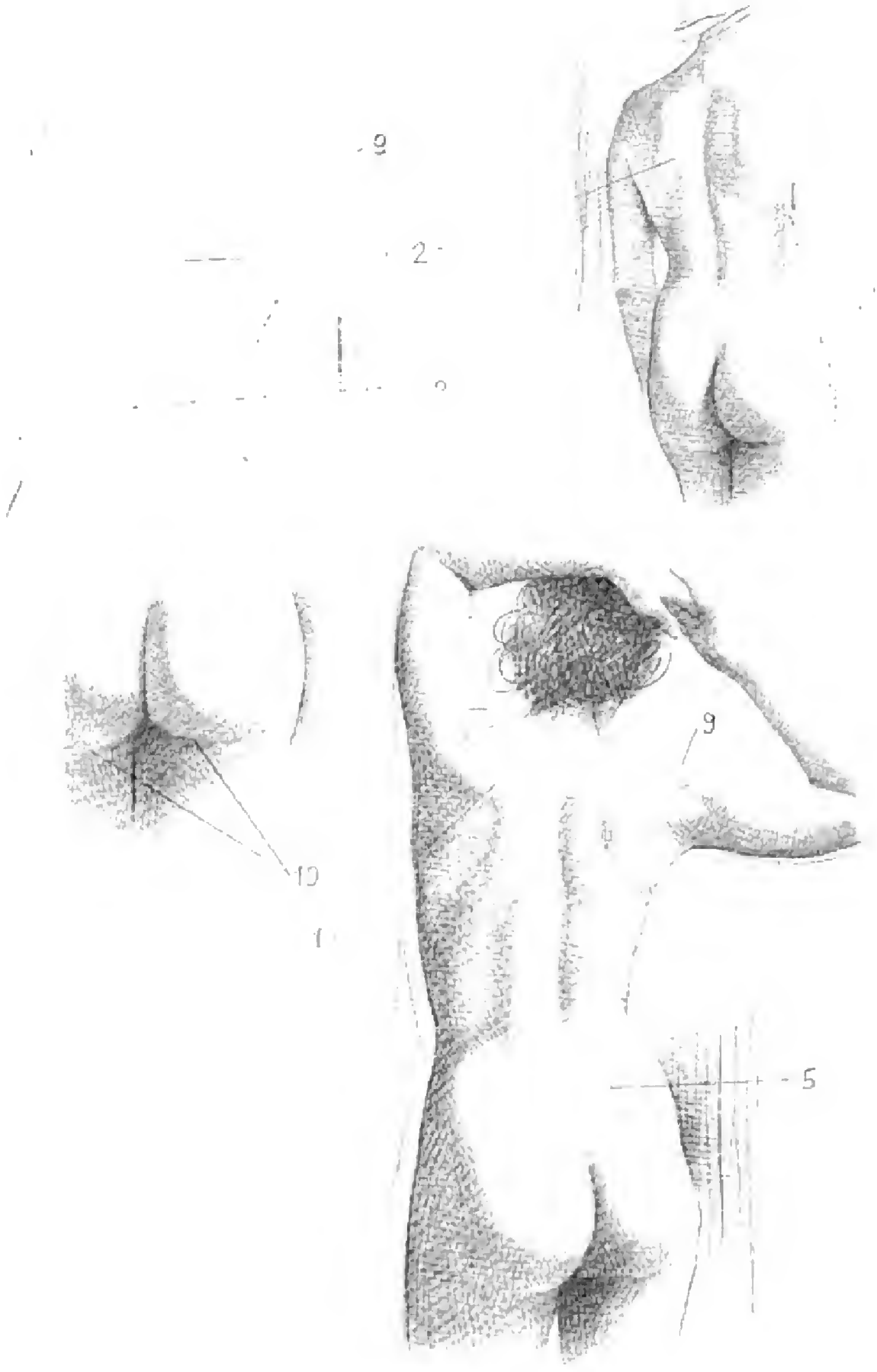
From an anatomical-morphological point however, the back corresponds to the posterior surface of the thorax. The upper portion confines with the nape (the limit is conventionally outlined by a transversal line that conjoins the lateral extremity of the scapula passing by the seventh cervical vertebra). The lower portion is confined by the lumbar region and corresponds at the sides to the obliquely positioned anterior border of the large dorsal muscle.

The back, positioned in this way, is stretched for its entire length on the median line of the spinal sulcus, which prolongs until the sacrum region. As is noted, when dealing with the vertebral column (see page 40), the spinose processes of the vertebra, with some exceptions, do not pair on the surface if the model is in the anatomical position. Everything is evident, however, during anterior flexion.

The sulcus starts at the seventh cervical vertebra, and is surrounded by the vertebral tract of the trapezium muscle, continuing in respect to the curvature of the column. Its depth, overall in the lumbar tract, relates to the development of the spinal muscular mass that is covered by the large dorsal muscle.

Sketch 37: Formation of the female back

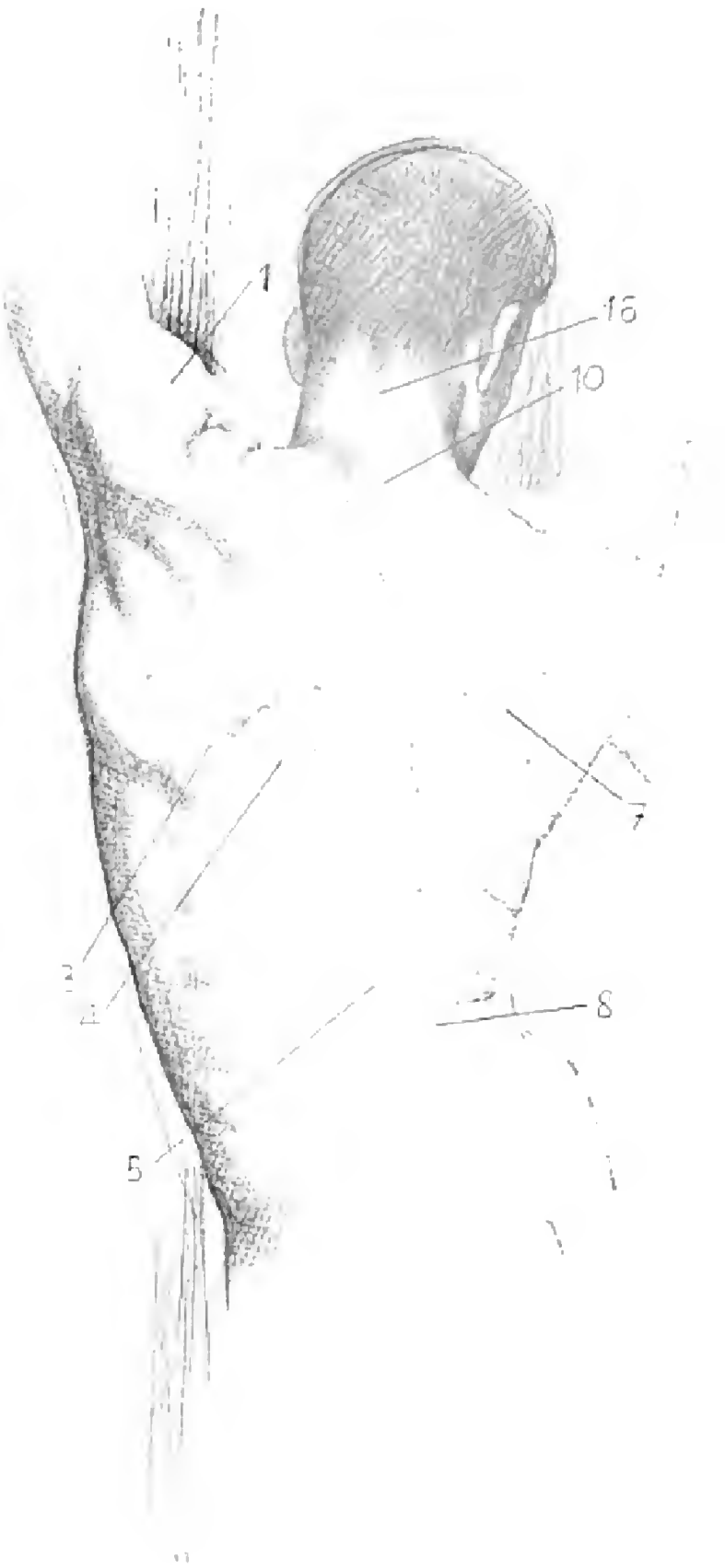
1 - Spine of the scapula
2 - Median margin of the scapula
3 - Seventh cervical vertebra
4 - Twelth rib
5 - Lateral lumbar dimple
6 - Spinal sulcus
7 - Large round
8 - Large dorsal
9 - Acromion
10 - Gluteus crease



The scapulas are situated on the sides of the spinal sulcus. The scapulas pair only with the median border and the oblique projection of the shoulder blades. The remaining parts are covered by gross muscular regions (deltoid, infraspinate, large round, trapezium, and large dorsal).

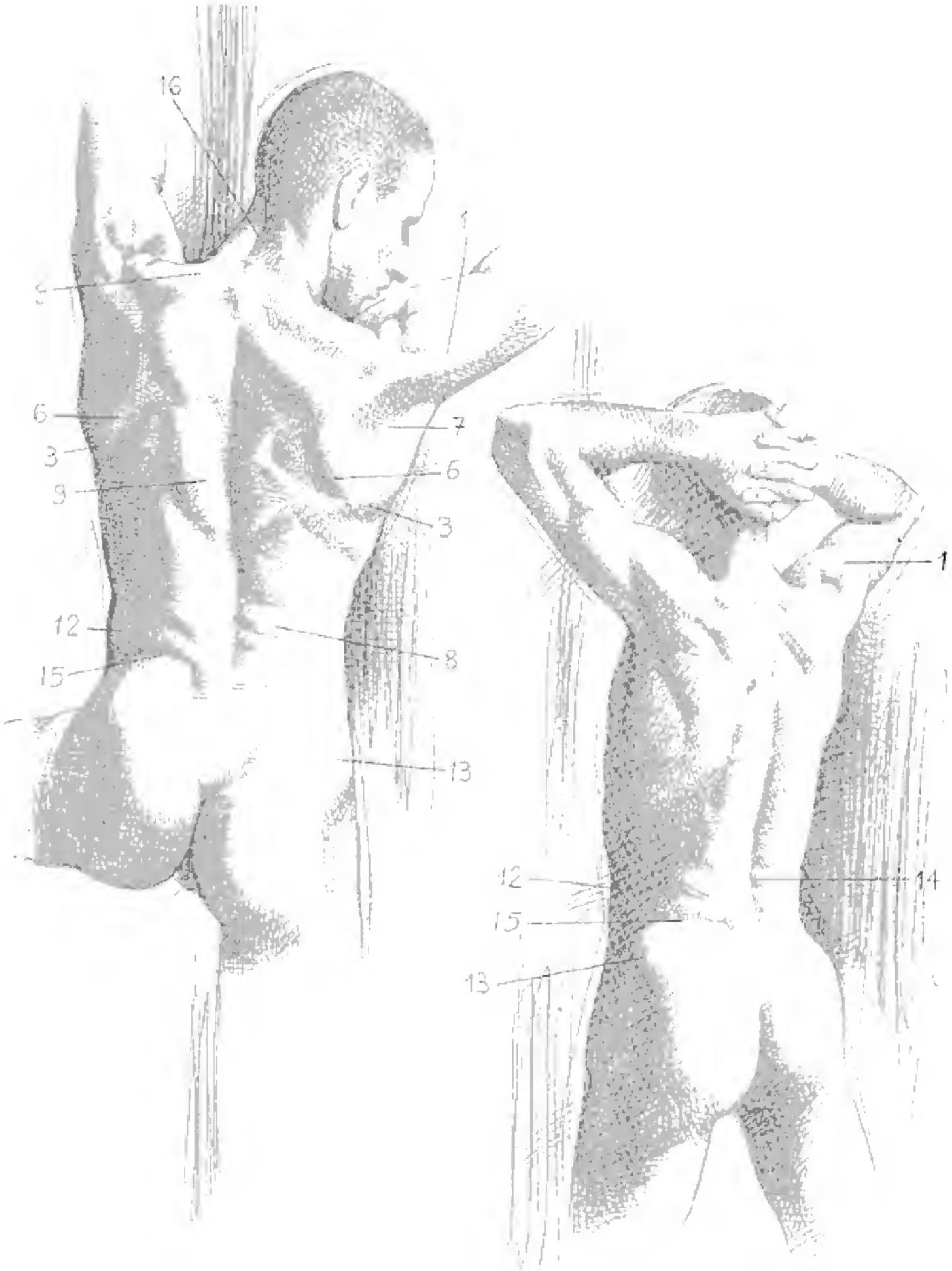
The lower region of the scapula extends almost entirely during the extension of the large dorsal muscle. The robust large dorsal muscle is flattened and follows the form of the underlying bone-muscle structure. It is not rare to see the development of the last rib, particularly during the anterior flexion of the trunk.

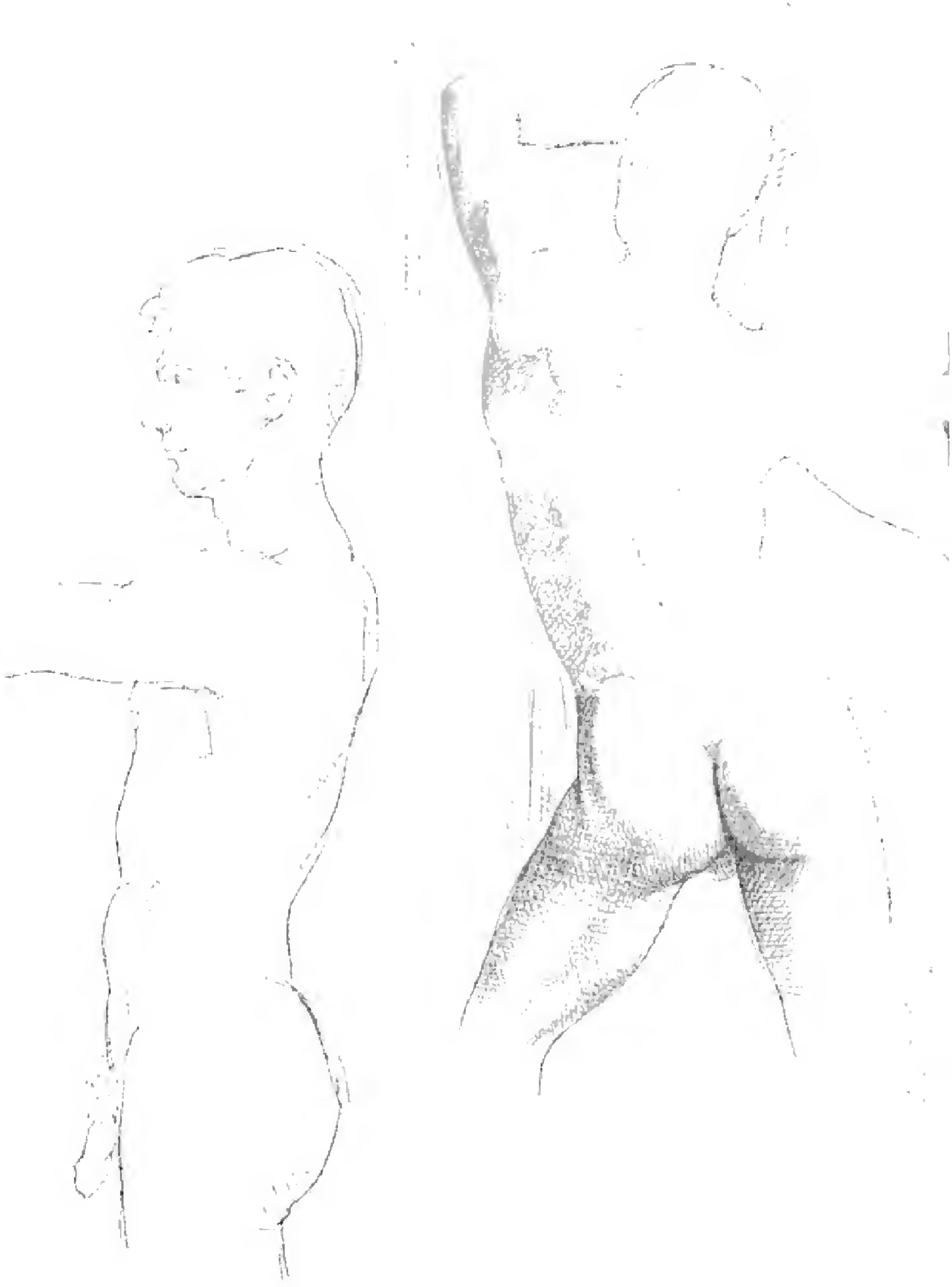
The narrow lumbar region has a rhomboid form and corresponds to the posterior surface of the abdomen. It follows the median longitudinal sulcus of the spinal region to the sacrum, while the sides of the trunk confine its sides. The surface of the lumbar region is characterized by the distinct column projections of the parallel spinal muscles at the sides of the vertebrae. They are covered by the aponeurosis of the large dorsal. At times they are transversally covered by a slight skin sulcus directly towards the sides and slightly curved upward. At the confines of the sacrum region it is interesting to note the presence of the lateral lumbar dimples, where the spinal sulcus concludes.

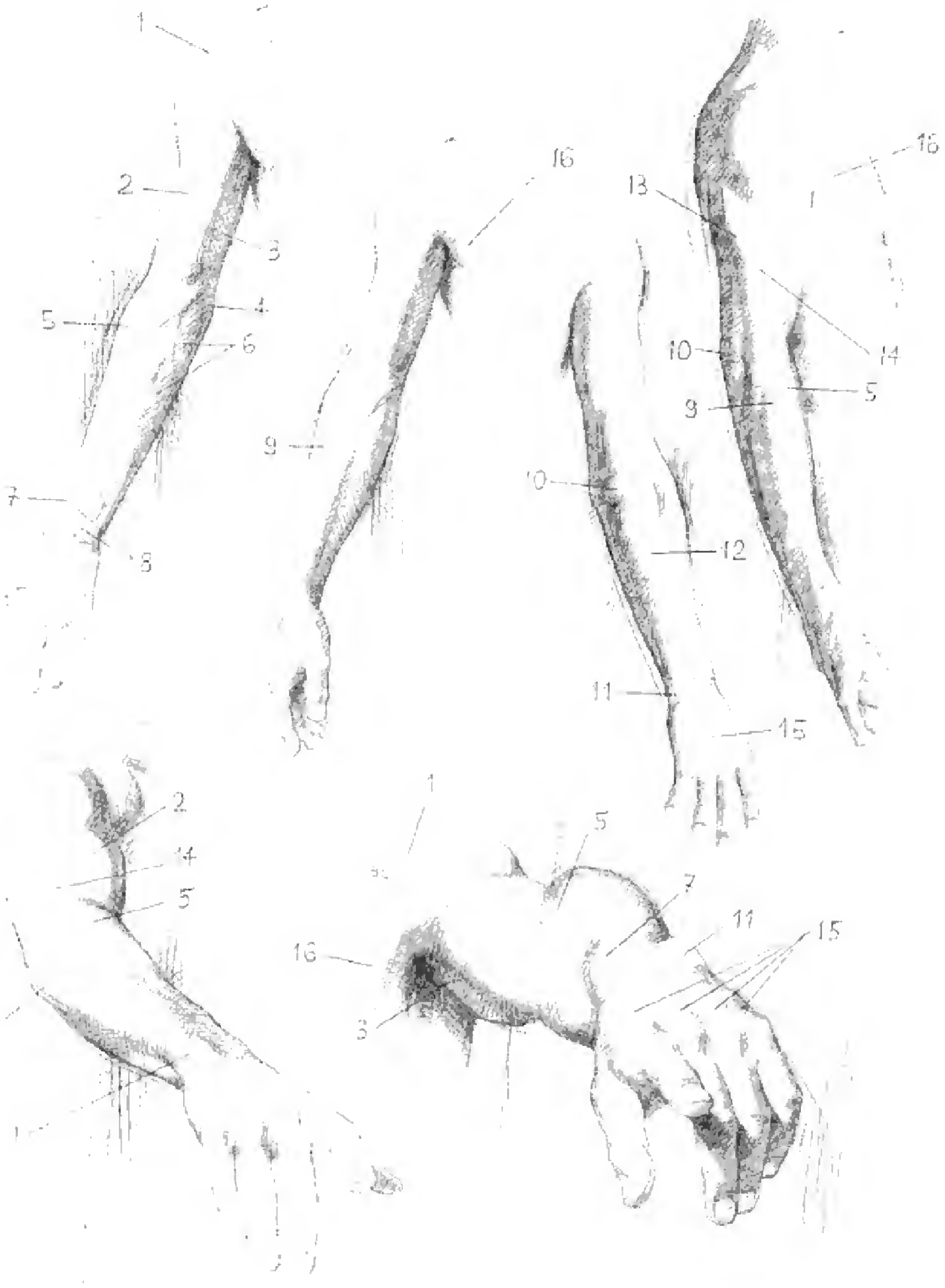


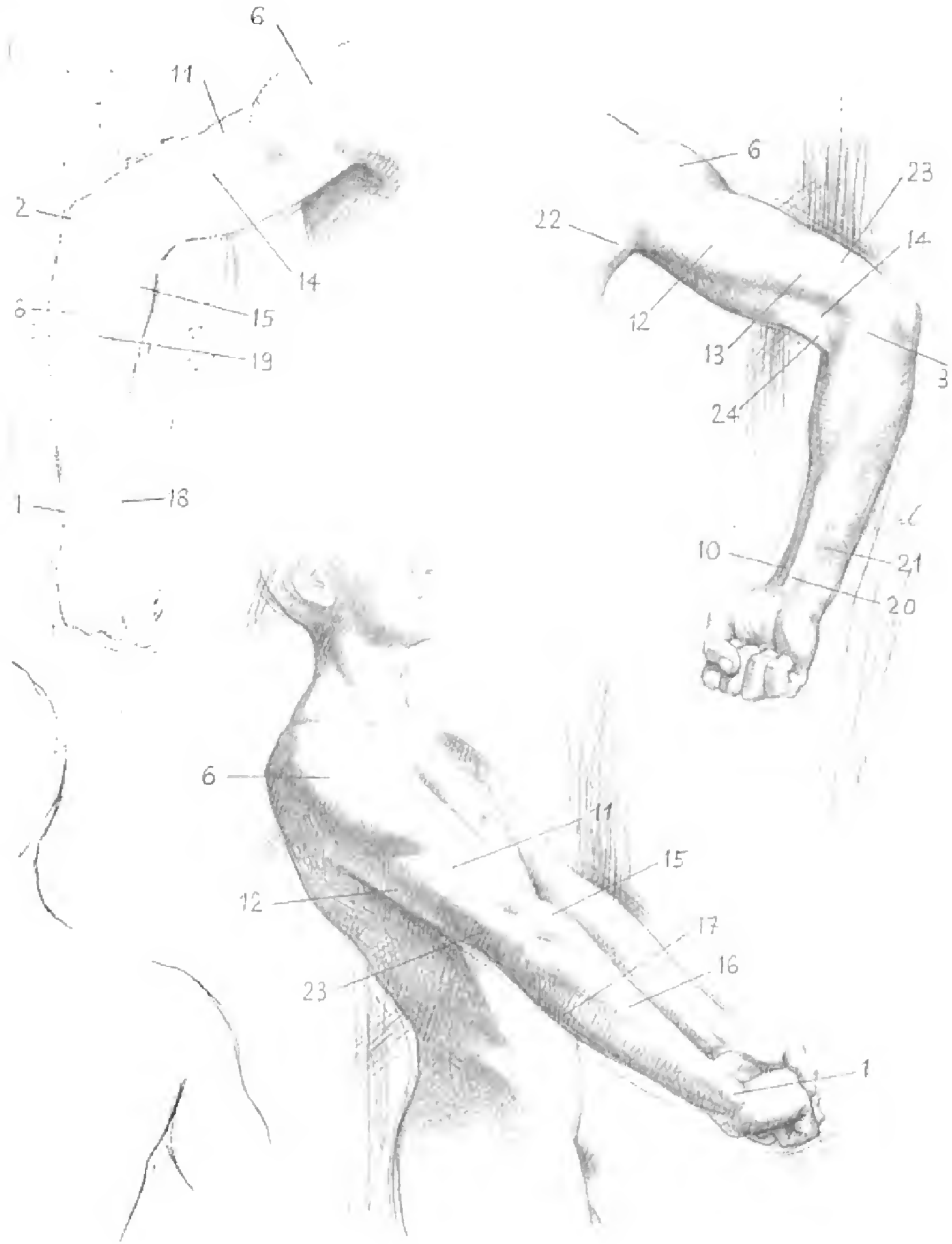
Sketch 38: Formation of the male back

1 - Deltoid
2 - Acromion
3 - Lower angle of the scapula
4 - Seventh rib
5 - Twelth rib
6 - Medain scapular margin
7 - Infraspinate muscle
8 - Group of ileum-rib muscles (covered by the large dorsal)
9 - Trapezium
10 - Seventh cervical vertebra
11 - Large dorsal
12 - Oblique extern
13 - Gluteus medius
14 - Lumbar sulcus
15 - Iliac line
16 - Median sulcus of the neck (nape)









The ulna is a long bone with a complex form, contrary to that of the radium. It is posted medially in the forearm. The radium has triangular sections. In the upper tract it is large and robust, while it becomes more refined and rounded in the lower tract. The upper extremity is very voluminous and constitutes the principle part of articulation with the humerus. The lower extremity is very subtle and cylindrical with a brief but evident process situated posterior-medially.

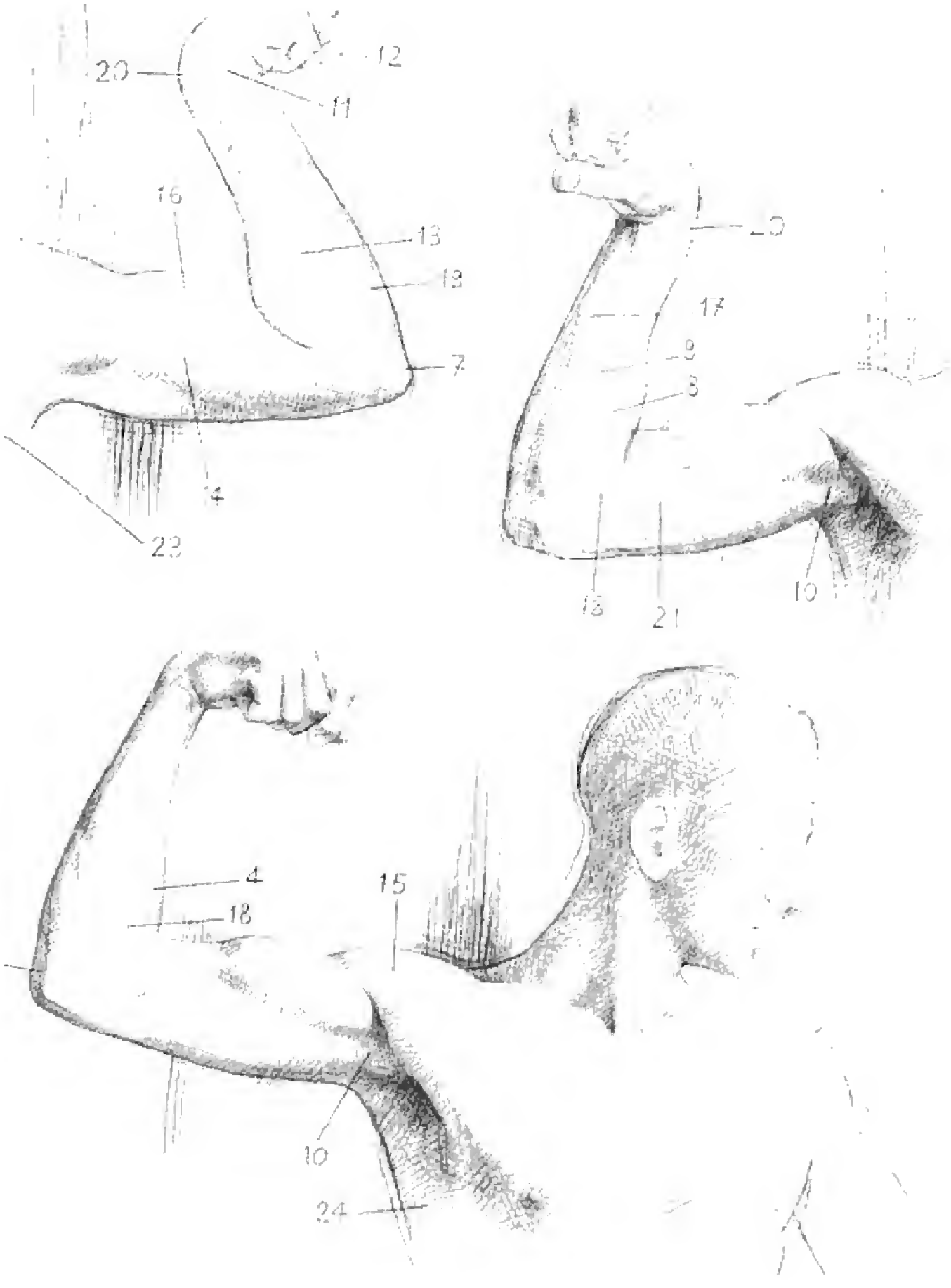
Eight short bones, each with morphological characteristics, form the carpus. In their entirety they constitute a flattened half- moon formation, which is slightly concave in the anterior. The bones arrange in two flanked lines, each composed of four elements, but aligned in an irregular and complex manner.

The metacarpus is made up of five bones of diverse length and peculiar characteristics, which are, however, conducive to a common structure. They are a cylindrical body that is curved at the anterior concavity, a well-developed and hemispheric head in articulation with the phalanges, and an irregularly cubical narrow base in articulation with the bones of the carpus.

The phalanges are the small bones of the fingers that are positioned in a string, three for each finger; excepting the pollex (thumb), which is made up of only two (missing the intermediate). The proximal phalanges are the largest. The base joins with the metacarpi and the head with the succesive phalanges. The middle phalanges have similar characteristics to the first, but are smaller in dimension. The distal phalanges are very short and terminate with the enlargement of the spatula, which serves as a support for the nail.

Sketch 42: Aspects of the male upper limb

1 - Long extensor of the pollex
2 - Short extensor of the pollex
3 - Long abductor of the pollex
4 - Brachioradial
5 - Long extensor tendon of the pollex
6 - Brachial
7 - Ulna (olecranon)
8 - Radial flexor of the carpus
9 - Long palmar
10 - Coraco-brachial
11 - Ulna
12 - Abductor of the fifth finger
13 - Ulnar extensor of the carpus
14 - Triceps: lateral head
15 - Deltoid
16 - Brachial biceps
17 - Superficial flexor of the finger
18 - Round pronator
19 - Ulnar flexor of the carpus
20 - Radium
21 - Triceps (median head)
22 - Median condyle of the humerus
23 - Large round
24 - Large dorsal



Notes on Arthrology

There are many free joints in the upper limb, in ratio to the quantity of humerus bone segments at the hand.

In functional and morphological consideration, the joints are divided into three groups: the joints of the scapular belt (see page 40), the joints of the free part (scapula-humerus joint, elbow joint, distal and proximal radium-ulna joint and radium-carpus joint), and the joints of the hand.

The scapula-humerus joint, or shoulder joint, effects the union between the head of the humerus and the glenoid cavity of the scapula. The two joint heads have no differences in extension and of surfaces at contact. The head of the humerus is quasihemispherical, while the glenoid cavity is enlarged and concave. Notwithstanding the presence of a robust joint capsule, reinforced by ligaments and expansion tendons of adjoining muscles, it allows ample possibility of movement, including abduction, flexion, extension, and circumduction.

The elbow joint effects between the humerus arm bone and the two bones of the forearm, the ulna and the radium. The joint is an articulation composed of three head joints contained in a single capsule. The specific characteristics of each head joint in relation to the others allow the angular displacement on a plane of only flexion and extension.

The joints between the ulna and the radium are structured to allow the characteristic pronation movement of the forearm. In the supine position the two bones are parallel. The pronation movement makes the radium rotate onto the ulna, turning over the palm of the hand.

The radium-carpus joint conjoins the forearm at the hand and effects between the lower joint surface of the radium and the bone of the proximal line of the carpus. Flexion and extension are the more ample movements; abduction, adduction, and circumduction are present in more limited measure.

The joints of the hand are particularly complex. The single bone segments have numerous surfaces of contact. A network of ligaments, which stabilize or render support in the movements, conjoins them. They can be divided into groups: carpus joints, carpus-metacarpus joints (relevant to the joint which corresponds to the pollex), intermetacarpal joint, metacarpus-phalange

Sketch 43: Aspects of the male upper limb

1 - Anconeus
2 - Triceps: lateral head
3 - Brachioradial
4 - Long radial extensor of the carpus
5 - Short radial extensor of the carpus
6 - Common extensor of the finger
7 - Short extensor of the pollex
8 - Long abductor of the pollex
9 - Deltoid
10 - Triceps: median head
11 - Ulna: olecranon
12 - Ulnar flexor of the carpus
13 - Radial flexor of the carpus
14 - Ulna
15 - Brachial
16 - Tendon of the triceps
17 - Brachial biceps
18 - Radium
19 - Bone of the carpus

joints (which conjoin the head of the metacarpus to the base of the first phalange of the five fingers), and inter-phalange joints (which conjoin the phalanges of each finger). In the last two groups of joints, the articulation surfaces are bound at contact by the capsule and the collateral ligaments. The only consenting movements are of flexion, accentuated enough to almost rejoin at a right angle, and of slight extension.

Notes on Myology

There are many muscles of the upper limb. The number of muscles in a proximal-distal direction increases considering the augmented bone angle and the specific function of the hand.

The muscles in relation to the corporal axis sector and the upper appendicular sector function on the scapular belt and the proximal tract of the humerus. They are the axo-appendicular muscles (including the spinal-appendicular and the thorax-appendicular muscles) and shoulder muscles. This has been noted when dealing with the trunk (see page 56). The muscles of the arm are long and parallel at the humerus, which they cover almost completely. The flexor muscles of the forearm are posted in the anterior loggia (biceps, coracobrachial, brachial, and anconeus). Only one extensor muscle, the triceps, is posted in the posterior loggia. The muscles of the forearm are even more numerous and include a paunch, which prolongs in subtle tendons. Therefore, the forearm tract has a larger diameter at the elbow in respect to that of the wrist. They are divided into two groups, which prevalently work on the hand. They are the flexor muscles posted in the anterior loggia (round pronator, radial flexor of the carpus, superficial flexor of the finger, etc.) and the extensor muscle posted in the posterior loggia (common extensor of the finger, ulnar extensor of the carpus, long extensor of the pollex, etc.).

The hand muscles are located on the surface of the palm. On the dorsal surface, only the forearm extensor muscles are found. The muscles are short, flattened, and divided into three groups. The muscles of the thenar eminence are laterally situated in correspondence to the pollex (short abductor, short flexor, opponent and abductor of the pollex). The muscles of the hypothenar eminence are situated medially (addector, short flexor, opponent of the little finger). The groups of inter-bone and lumbar muscles are situated between the metacarpi.

Sketch 44: Aspects of the female upper limb

1 - Deltoid
2 - Large pectoral
3 - Ulna: olecranon
4 - Humerus: median epicondyle
5 - Condiloidea depression
6 - Retro-deltoid fatty deposit
7 - Ulna
8 - Radium
9 - Ulna margin
10 - Superficial flexor of the finger
11 - Ulnar flexor of the carpus
12 - Ulnar extensor of the carpus
13 - Radial flexor of the carpus
14 - Round pronator
15 - Biceps
16 - Coraco-brachial
17 - Triceps
18 - Brachial

Sketch 45: Aspects of the female upper limb

Morphology of the Elbow

(sketch 47)

On the upper-limb skeleton, the elbow corresponds to the homonymous joint, realized by the humerus, ulna, and radium. In an anterior-posterior sense, it has a very flattened cylindrical form.

The morphology of the anterior region (elbow fold) in the anatomic position is determined by three muscular protrusions. The inferior portion of the biceps meets the median protrusion by its tendons and the annexation of fibrous sinews from the lower part of the brachial. The rounded lateral protrusion is made up in large part of the muscles of the anterior portion (forearm extensors). They originate from the epicondyle and the lateral margin of the humerus (the radiobrachial and the long radial extensor of the carpus). Muscles of the anterior portion of the forearm (flexors) constitute the medial protrusion. They originate from the epitrochlea of the humerus (the round pronator, the gracilis muscle, the ulnar flexors, and the radial flexors of the carpus).

A triangular-formed depression with vertexes across the base (cubital pit) is found below the median muscular protrusion. Passing the arteries and gross nervous fascicles, it presents a structural analogy with the posterior surface of the knee. Two other muscular protrusions determine the asymmetrical frontal profile of the elbow. The lateral group, posted slightly higher, covers the lateral epicondyle of the humerus and forms an ample, accentuated curvature. The median group originates below the medial epicondyle (epitrochlea). Posted lower, it forms a shorter, less accentuated curvature. Above the muscular protrusion, the epitrochlea is under the skin. Slightly concave skin folds develop on the anterior surface of the elbow across the upper portion. They are situated at the level of the biceps tendons and are accentuated when the forearm is flexed at a quasi-recto angle to the arm. Two major veins, the basilica and the cephalic, develop it. Laterally, two small branches, the median cephalic and the median basilica, connect the basilica and medially the cephalic. Their complex disposition resembles an M, but with individual variation.

The posterior region is occupied by the sub-skin bone projections of the olecranon and the ulna. They become very evident during maximum flexion of the forearm. During the anatomic position of the arm, the projection is situated in the region almost centrally. It is covered by abundant gross skin folds that are transversally posted and gathered together, rendering the surface wrinkled overall. This is more accentuated in older individuals, but it distends and disappears during flexion of the forearm. The olecranon is flanked medially by a small hollow that separates from the epitrochlea. Laterally, the hollow separates the olecranon from an ample profound depression defined by the anconeus and the lower margin of the long radial extensor of the carpus. This depression is called condylar because it corresponds to the condyle of the humerus, which joins with the head of the radium.

The external morphology of the elbow, particularly posteriorly, varies in relation to the movements of flexion, when the olecranon and the medial and lateral epicondyles are more evident. On the anterior surface, the robust tendons and cord form of the biceps project at the center. The subtle diagonal projections of the fibrous sinew also annex somewhat medially at this muscle.

Sketch 47: Formation of the elbow

1 - Cubital pit and fold of the elbow
2 - Tendons of the biceps
3 - Group of extensor muscles
4 - Group of flexor muscles
5 - Ulna: olecranon
6 - Humerus: lateral epicondyle
7 - Humerus: medial condyle
8 - Ulna
9 - Median basilica vein
10 - Median cephalic vein

Morphology of the Forearm

(sketches 48–49)

The forearm is the segment of the upper limb compressed between the elbow and the wrist. Its external form varies notably, according to the movements of supination and pronation. Under these movements the radium places itself at the ulna, crossing it, provoking torsion of the muscles and the consequent modification of their projection.

In the anatomic position, the forearm has a flattened cone form in an anterior-posterior sense (while it can be noted that the arm is transversally flattened). It is more enlarged in the upper half, where the mass of most of the muscles of the region are situated. It tapers in the lower half, where it runs along the ulna and the radium, due to only the tendons of single muscles.

The anterior surface of the forearm is flattened. It is formed in the lower portion of two muscular projections separated by a weak longitudinally posted median hollow. Brachioradial muscles and long and short radial extensors of the carpus constitute the consistent and voluminous lateral projection.

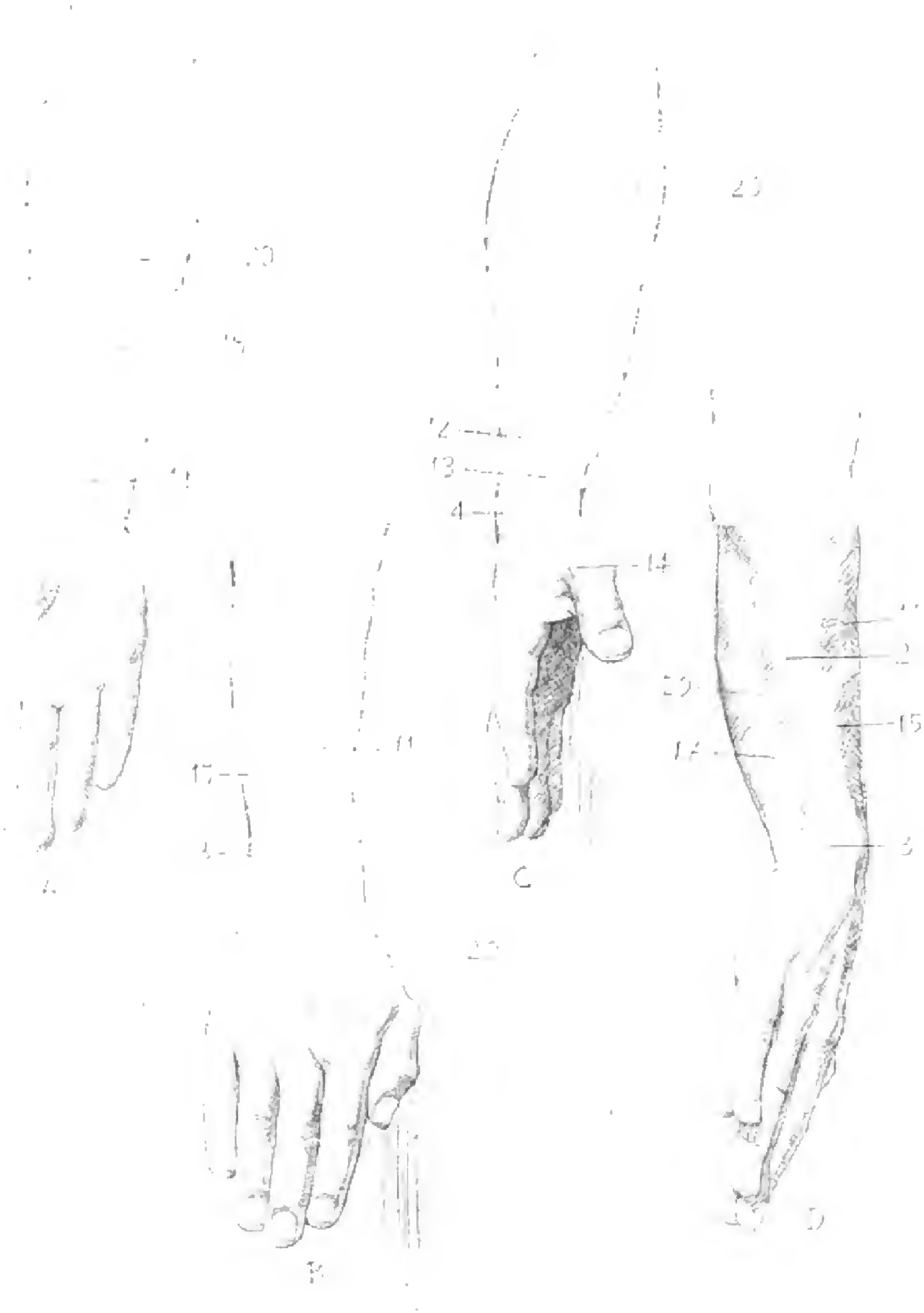
Muscles of the anterior loggia constitute the more exiguous medial projection. They originate in the epitrochlea of the humerus. They are flexor muscles, which place themselves in the upper portion of the round pronator. The lower half of the anterior surface is flattened. In proximity of the wrist it shows the subtle longitudinal projections of the flexor tendons.

The fine and hairless skin of the ventral surface leaves the development of the superficial venous reticule visible (at times projected when the limb is pending along the trunk). Its position is subject to individual variation.

Sketch 48: Formation of the forearm

A - Forearm in supination
B - Forearm in pronation
C - Forearm in semi-pronation
D - Forearm in forced pronation

1 - Ulna: olecranon
2 - Ulna
3 - Ulna
4 - Radium
5 - Long radial extensor of the carpus
6 - Brachioradial
7 - Round pronator
8 - Radial flexor of the carpus
9 - Anconeus
10 - Long palmar
11 - Common extensor of the finger
12 - Long abductor of the pollex
13 - Short extensor of the pollex
14 - Long extensor of the pollex
15 - Extensor of the little finger
16 - Ulnar extensor of the carpus
17 - Ulnar flexor of the carpus
18 - Common superficial flexor of the finger
19 - Long tendon of the palmar
10 - Superficial veins



Morphology of the Wrist

(sketches 50–57)

The wrist, between the forearm and the hand, is made up of the lower extremity of the ulna and the radium, the first series of carpus bones, and the covering tissue. From the radium-carpus joint, it continues into the forearm with the same flattened cylindrical form. The dorsal surface is flat and medially projects the ulna. The extensor tendons of the fingers run on the surface, but are not visible due to adherent covering at the lower extremity of the radium. During maximum hand flexion, the wrist's dorsal surface becomes curved, causing the projection of the radium, the scaphoid, and the semilunare.

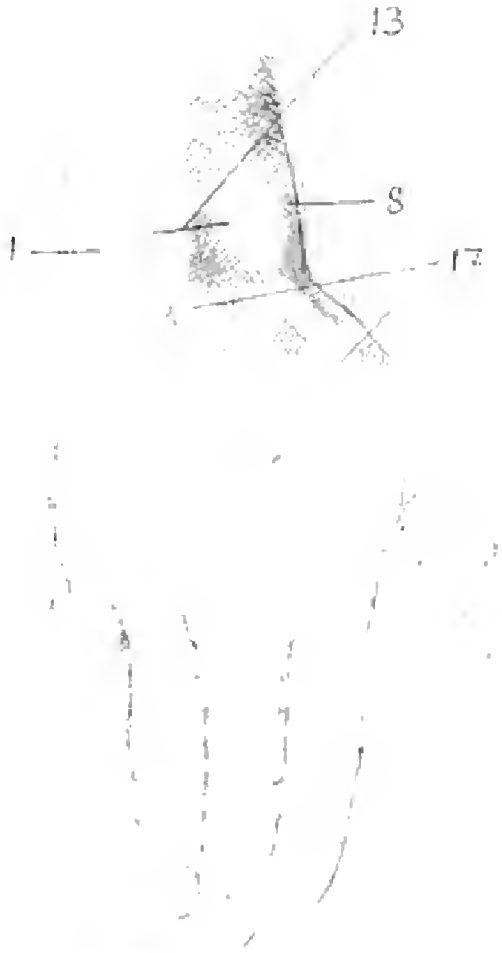
The medial margin is rounded, but presents at times a slight depression between the tendons of the ulnar flexor of the carpus and the ulnar extensor of the carpus. The flanked tendons of the long abductor, the short extensor of the pollex, and the long extensor tendons of the pollex obliquely cross the lateral margin. The tendons of the long abductor and the short extensor of the pollex cross the lateral margin in the anterior position, while the long extensor tendons of the pollex cross in a more dorsal position. In the "anatomic snuff box" indentation formed, the radium is seen under the skin.

The anterior surface is developed longitudinally by the tendons and flexion action on the hand. The direction of the tendons does not exactly follow the forearm axis, but is slightly oblique. The tendons visibly pair during the weak flexion of the hand. The long palmar posts on the median line of the wrist. It is subtler, being the only one running under the skin, and not covered by ligaments across the carpus. Across the lateral border the tendons of the radial flexor of the carpus are found. The tendons of the superficial flexor of the fingers and the ulnar flexors of the carpus pass across the medial border.

Sub-skin veins run along the wrist's anterior surface, along with skin folds of flexion. They are transversally disposed, almost horizontal but slightly concave across the upper portion. Two folds, near each other at the joint, are closely confined. A third, subtler crease is situated about one centimeter higher. The creases, like tendons, are distinctly delineated when the hand is in slight flexion. If the hand is in strong flexion, the small projection of the scaphoid is revealed in the compressed area between the visible terminal tract of the radial flexor of

Sketch 50: Formation of the Wrist

1 - Ulna
2 - Tendon of the ulnar flexor of the carpus
3 - Hypothenar eminence
4 - Thenar eminence
5 - Abductor of the fifth finger
6 - Skin crease of flexion
7 - Pisiform
8 - Radium
9 - Tendon of the abductor of the pollex
10 - Scaphoid
11 - Tendon of the long palmar
12 - Tendon of the radial flexor of the carpus
13 - Tendons of the extensor muscles, covered by the third finger ligaments
14 - "Anatomic snuff box"
15 - Long extensor of the pollex (tendon)
16 - Short extensor of the pollex (tendon)
17 - Superficial vein



Morphology of the Hand

(sketches 50–56)

The hand is the terminal tract of the upper limb, succeeding the wrist. Its external morphology, above all relative to the dorsal tract, is largely influenced by the skeletal structure. It is distinguished in two sectors: the hand itself and the fingers.

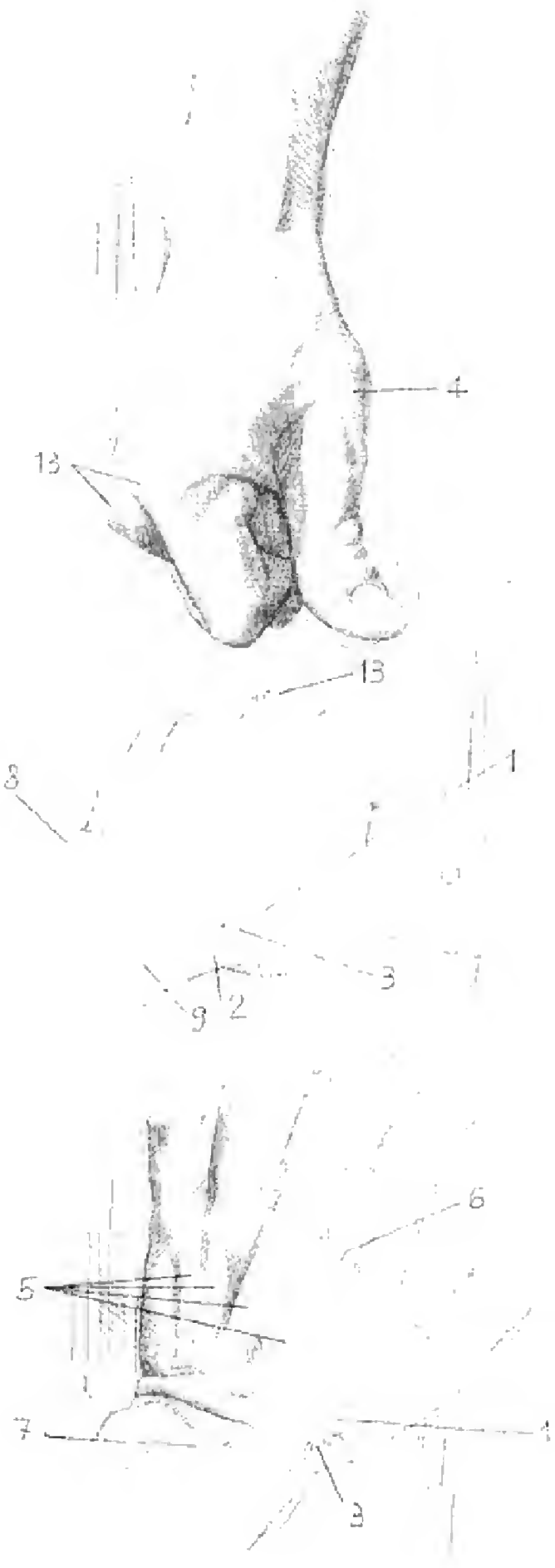
The anterior surface of the hand, the palm, is slightly concave at the center while it is projected along the margin, caused by muscular formation and adipose.

The oblique lateral projection is situated at the base of the pollex. It has an ovoid form and is more voluminous. The muscles of the thenar eminence (short flexor, short abductor, abductor and opponent of the pollex) constitute the medial projection.

The medial projection is an elongated form, brought near the lateral in the proximity of the wrist. It extends onto the border of the hand, corresponding to the middle finger. It is made up of the muscles of the hypothenar eminence (abductor, short flexor, and opponent of the little finger). The projection of the head of the metacarpi, covered and flanked by fatty ovoid cushions, determines the transversal projection.

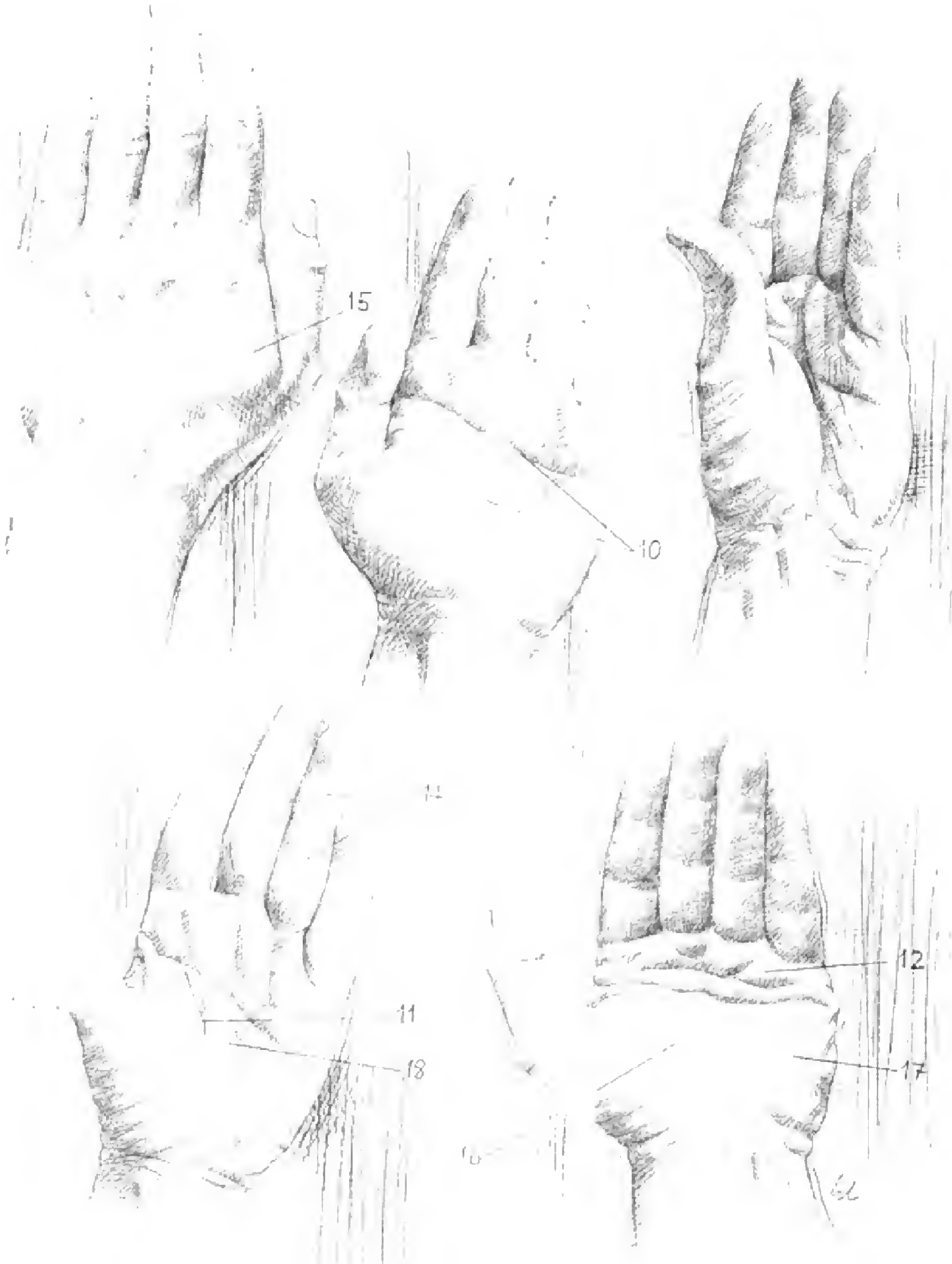
At the center of the hand the hollow of the palm surrounds these projections. The hollow is a permanent depression that accentuates flexing the fingers. It is determined by the adherence of the skin at the palmar aponeurosis, which completely covers the tendons of the flexor muscles of the fingers.

The skin of the palm is hairless and without visible superficial veins. It is developed by some characteristic creases, subject to individual variation. However, the flexion of the fingers and the abduction of the pollex constantly cause them. There are typically four palm creases or wrinkles, schematically positioned like the letter W: the pollex crease, that outlines the thenar eminence; the crease of the fingers, situated between the hollow and the transversal projection; the longitudinal crease; and the oblique crease, situated diagonally on the hollow of the hand. Other numerous and various



Sketch 51: Formation of the hand

1 - Long extensor of the pollex
2 - Long abductor of the pollex and short extensor of the pollex
3 - "Anatomical snuff box"
4 - First metacarpus
5 - Tendon of the common extensor muscles of the fingers
6 - Tendon of the extensor muscles of the index finger
7 - Dorsal ligament of the carpus (retinaculum of the extensors)
8 - Ulna
9 - Radium
10 - Palmar crease
11 - Crease of the pollex
12 - Transversal crease and projection
13 - Head of the metacarpus bone
14 - Phalange crease
15 - First inter-bone muscle
16 - Muscle of the thenar eminence
17 - Muscle of the hypothenar eminence
18 - Tendon of the flexor muscles, covered by the palmar aponeurosis



sulci form occasionally, following the movement of the fingers.

The medial margin of the hand is rounded due to the hypothenar eminence muscle. More specifically, in the proximal tract at the wrist, it is tapered towards the root of the little finger.

The lateral margin is occupied in the upper portion by the base of the pollex, while the lower free portion corresponds to the metacarpus-phalange joint of the index finger. Between the two portions of the margin are the gross skin creases, where the abductor muscles of the pollex are in part contained.

The dorsal surface of the hand is more curved and modeled on the bone structure, which is visible but not noticed overall except for the head of the metacarpus. Some tendons of the extensors of the finger run on the head of the metacarpus and are especially projected during maximum extension. There are two flanking tendons at the index finger. The common extensor of the fingers is posted laterally and the extensor of the index finger is posted medially. The skin of the dorsal side of the hand easily runs on the underlying planes and is more moveable than that on the palm. The back of the hand almost always has no fatty tissue. It is strewn with hair (especially in men), and visible reticular veins (of variable courses) run through it.

The five fingers have an approximately cylindrical form. They originate in the transversal distal margin of the hand.

The first finger (the pollex) has only two free segments. Each of the other fingers is made up of three free segments, jointed between and corresponding to the phalanges.

The dorsal surface of the fingers follows the bone formation. It is rounded and slightly curved. Abundant transversal skin creases interrupt the dorsal surface in correspondence to the joints. The joints are present at the first and second phalange, with some random hairs (especially in men).

Sketch 52: Some morphological aspects of the male hand

1 - Radium
2 - Ulna
3 - Hypothenar eminence
4 - Thenar eminence
5 - Scaphoid
6 - Pisiform
7 - Tendons of the extensor muscles
8 - Superficial veins of the back of the hand
9 - Tendon of the long extensor of the pollex
10 - Dorsal skin creases (projected and in abundance) between the first and second phalange
11 - Dorsal skin crease (flattened) between the second and third phalange
12 - Skin crease of flexion between the second and third phalange
13 - Creases of flexion (doubled) between the first and second phalange
14 - Inter-finger skin creases
15 - First dorsal inter-bone muscle and abductor muscle of the pollex
16 - Tendon of the ulnar flexor muscle of the carpus
17 - Tendons of the flexor muscles (covered by the palmar aponeurosis)

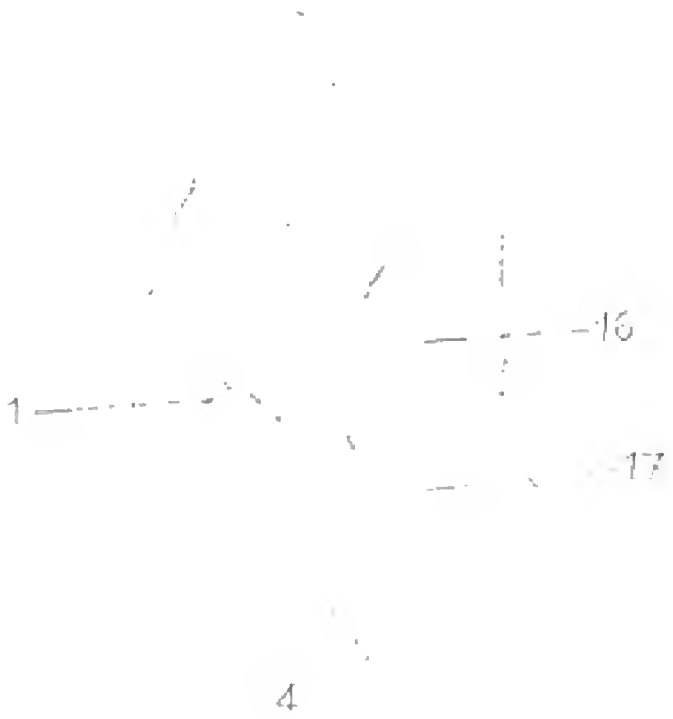
On the back of the third phalange, the presence of the nail is characteristic. The nail is a laminate skin annexation of quadrangular or elliptical form. It is slightly curved transversally and occupies half the length of the phalange. A three-sided skin projection that is easily observable in life surrounds the nail. The thumbnail is always larger in dimension in respect to the others. The nails are proportionate in size to the finger to which they belong.

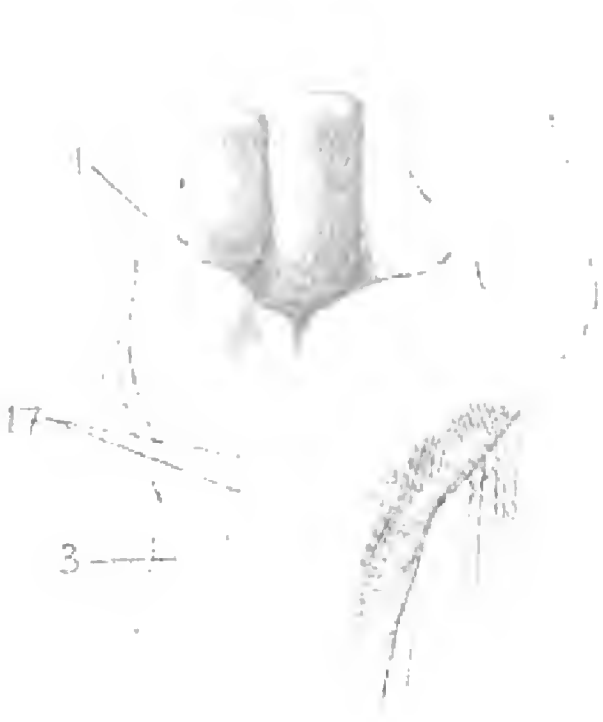
With the exception of the pollex (thumb), which has its own characteristics and is formed by only two phalanges, each finger is a different length. This is caused by the diverse levels of origin of each finger due to the head of the metacarpus, which follows a curved line at the base.

The third finger (middle finger) is usually the longest, followed by the fourth (ring finger), the second (index finger), and the fifth (little finger). Comprehensively, these four fingers pair longer on the dorsal surface than on that of the palm. On the palm, the transversal distal rejoins half of the first phalange, formed by the creases of the inter-finger union.

The volar surface of the fingers is divided into three curved sectors. They are made up of fatty cushions separated by flexion. The two distals correspond exactly to the relative joints. The upper forms near the half point of the first phalange. The creases are doubled or formed by two fine parallel lines, while the crease between the second and third phalanges is usually single.

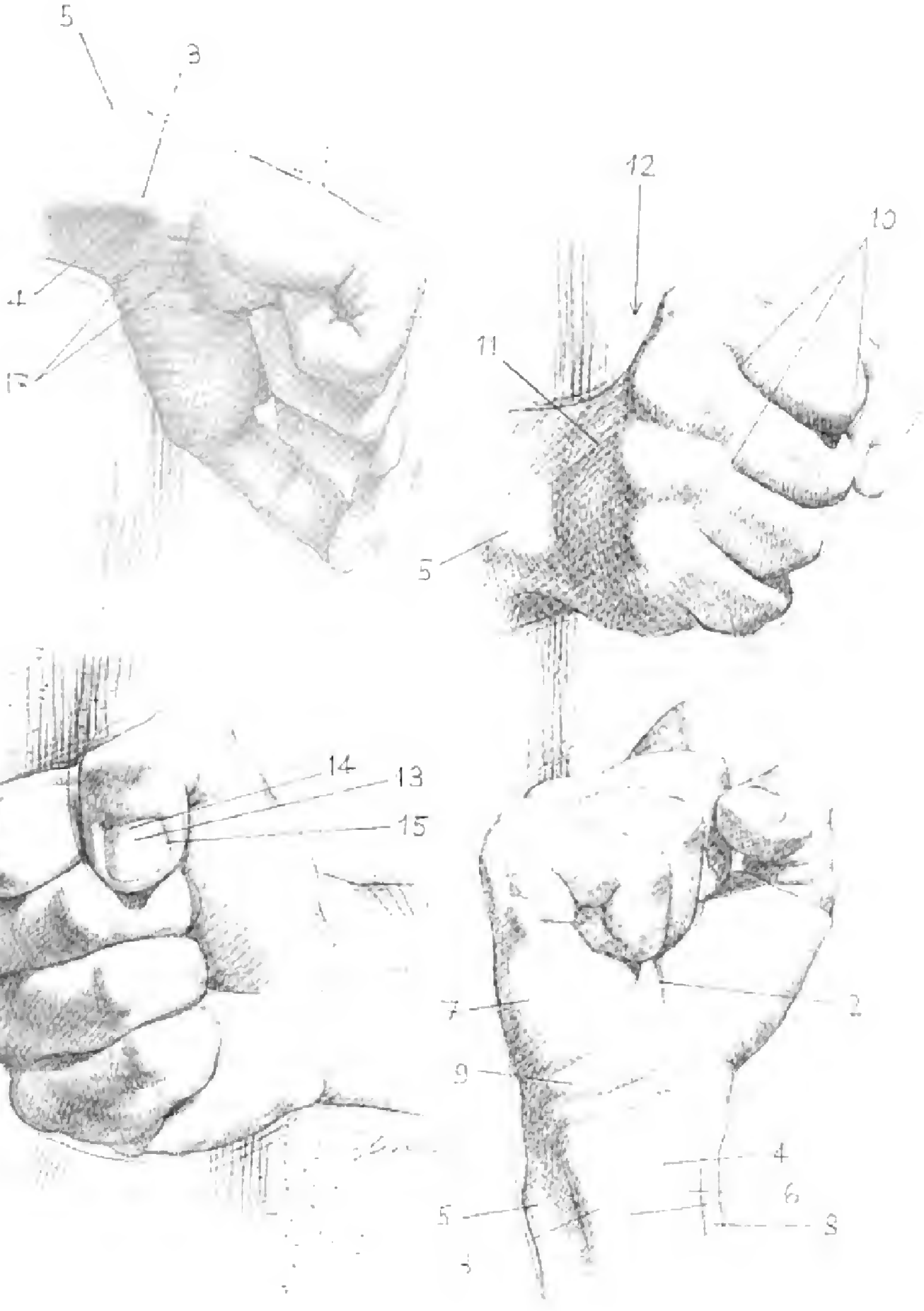
The projection of the last phalange, or ball of the finger, has an ovoid form. Its skin is creased by an individually characteristic epidermal crest (fingerprint).

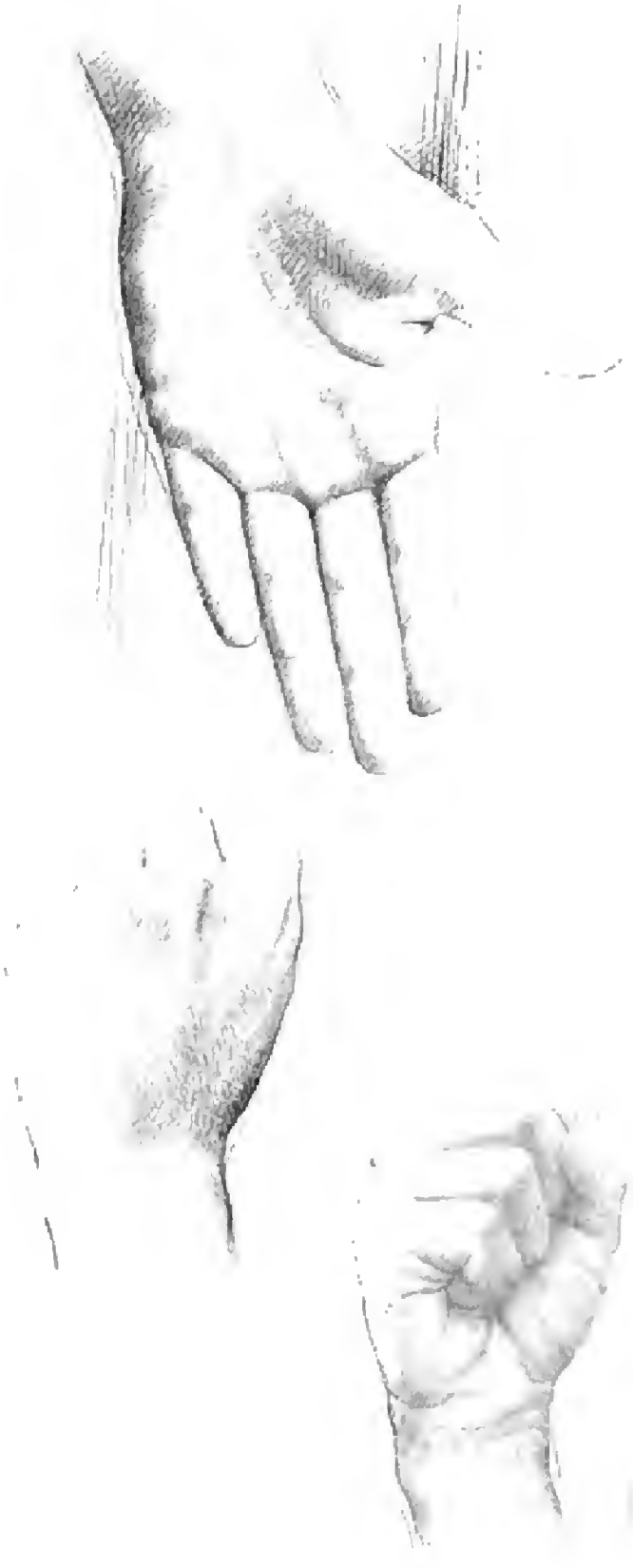




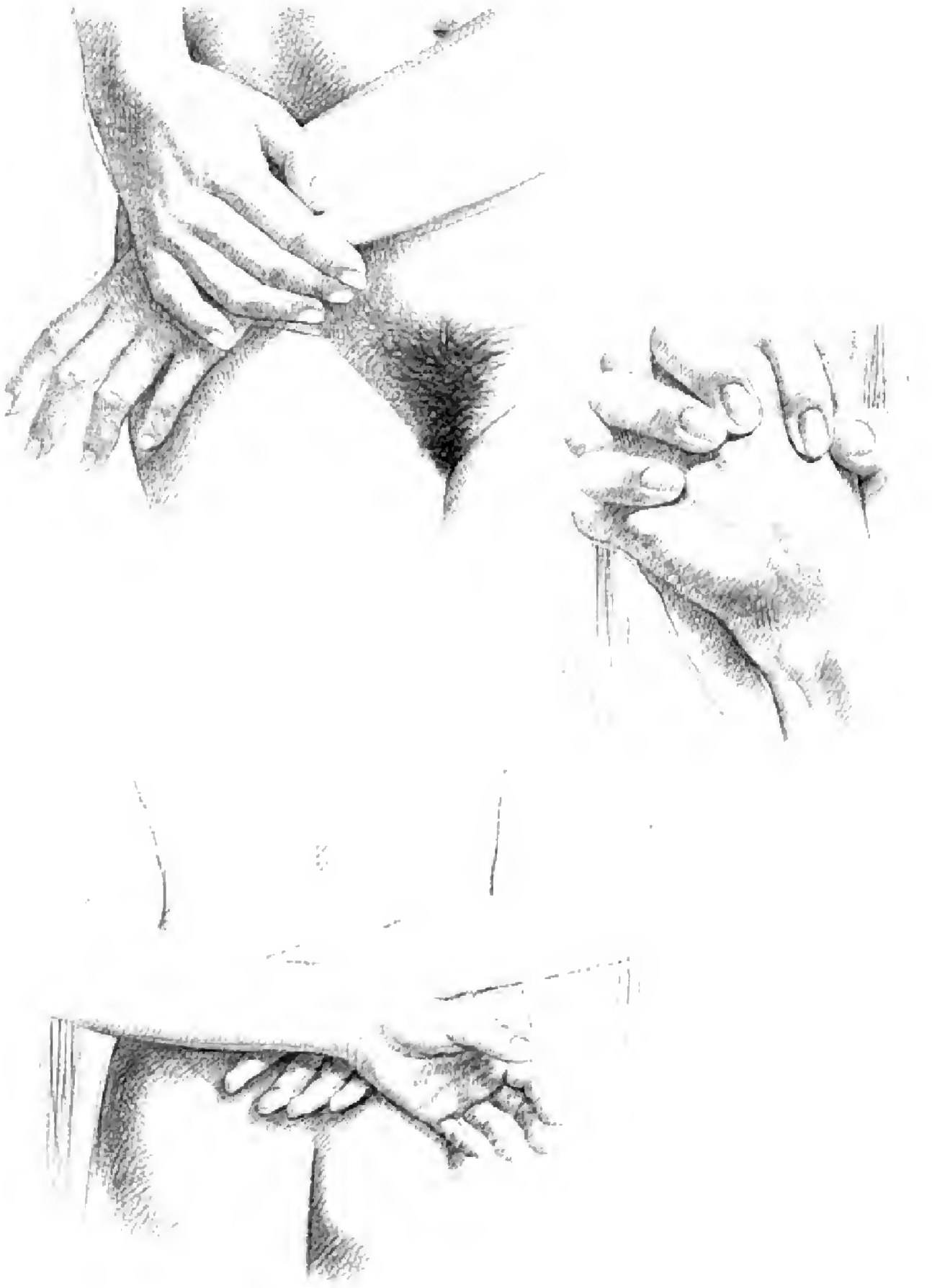
Sketch 53: Morphological aspects of the tightly fisted male hand

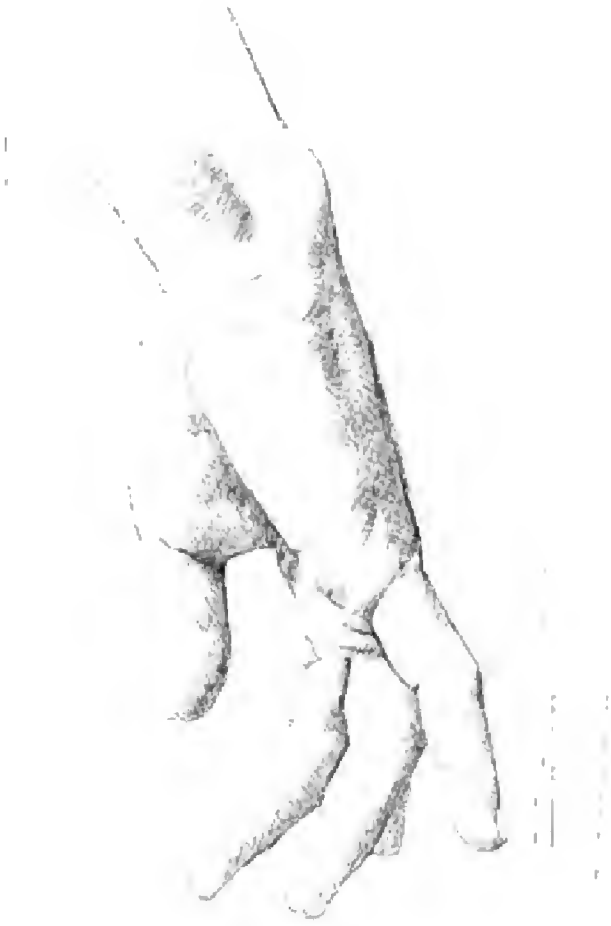
1 - Medial extremity of the transversal palmar crease
2 - Crease of the pollex
3 - Tendon of the ulnar flexor of the carpus
4 - Tendon of the long palmar muscle
5 - Ulna
6 - Tendons of the superficial flexor muscles of the fingers
7 - Abductor of the fifth finger
8 - Tendon of the radial flexor of the carpus
9 - Pisiform
10 - The dorsal skin creases of the finger stretch during flexion and the sulci formed by the inter-finger creases obliquely terminate directly toward the ateral border of the back of the hand
11 - Tendons of the extensor muscles of the finger
12 - The curvature of the back of the hand becomes accentuated and the index finger slightly protrudes in respect to the other fingers
13 - Nail (laminate ungual)
14 - Lunula
15 - Vallo ungual
16 - Thenar eminence
17 - Flexion crease of the wrist





Sketches 54–56: Actions and gestures—morphological aspects of the male and female hand





and posterior group. The foot is the terminal part of the lower limb. Contrary to the hand, the foot does not prolong the longitudinal axis of the limb. The foot attaches in a right-angle at the heel.

The form of the foot is arched and curved on the dorsal surface. It is concave on the medial margin of the plane, a sector that corresponds to the bones of the tarsus and metatarsus.

The phalanges of the toes constitute the distal tract of the foot, which is usually flattened and enlarged.

Notes on Osteology

The skeleton of the lower limbs repeats the regulating plane of the upper limbs. It is formed by an attachment at the skeletal axis (the pelvis, see page 44) and the bones that compose the free part. They are: the femur, or bone that corresponds to the upper leg and is annexed at the kneecap; the tibia and fibula, which corresponds to the lower leg; and the tarsus, metatarsus, and phalanges, which correspond to the foot.

The femur is the most robust and voluminous long bone of the human skeleton. The diaphysis, which has a moderate curvature in an anterior-posterior direction, presents three facets. These facets are the anterior curved lines, the more leveled and posteriorly convergent laterals in a longitudinal crest (rough line). The proximal epiphysis is characterized by the presence of a spheroid formation (head of the femur, which joins with the pelvis by inserting itself in the acetabulum cavity) connected at the diaphysis, for the path of the femur neck at the base. Here two projections of unequal volume (the large and small trochanters) are revealed.

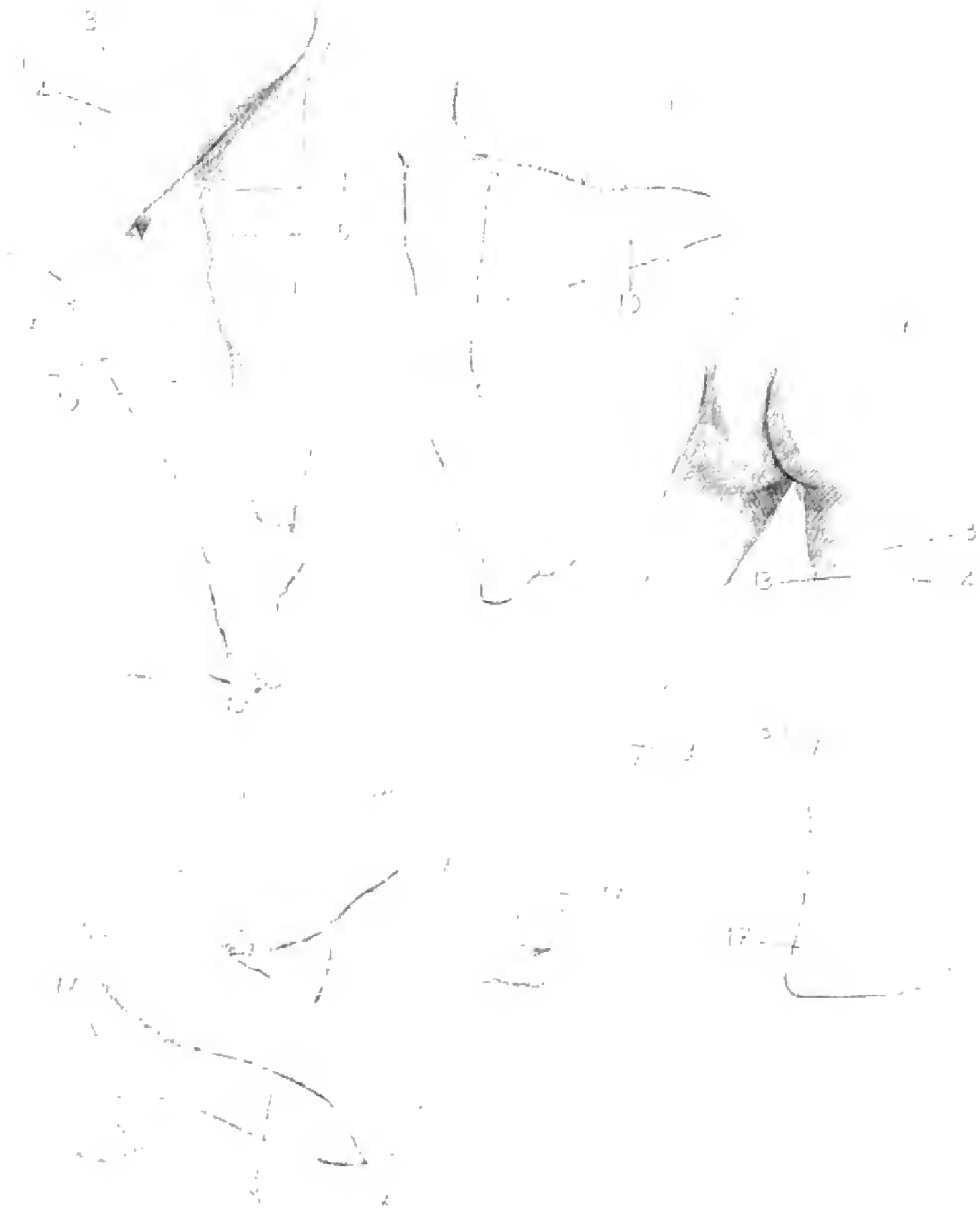
The distal epiphysis is very large. It has two lateral projections (medial condyle and epicondyle, lateral condyle and epicondyle), which are separated by a profound indentation.

The kneecap is a short bone. It is formed by an irregular disc, which is slightly flattened in the lower portion and of various densities. It is situated between the femur and the tibia and contained in the tendon of the quadricep muscle.

The tibia is medially situated in the lower leg. It is a long column-shaped bone with a large upper epiphysis and a smaller lower epiphysis. The diaphysis appears to be formed by three facets that are united by a clear margin. The anterior-medial surface is subcutaneous

Sketch 58: Some morphological aspects of the male lower limb

1 - Sartorius
2 - Recto-femur
3 - Wide fascia
4 - Vast lateral
5 - Vast medial
6 - Kneecap and kneecap tendon
7 - Head of the fibula
8 - Lateral twin
9 - Medial twin
10 - Soleus
11 - Anterior tibia
12 - Long peroneal
13 - Femur biceps
14 - Semitendonous
15 - Semimembranous
16 - Gracilis muscle
17 - Heel tendon (Achilles tendon)



because the muscles do not cover it. The upper epiphysis is the more voluminous part of the tibia. It has a visible expansion whether at the sides or in the posterior portion, and evidences a tuberosity on the anterior surface. The upper plane of articulation with the femur presents two surface joints separated by a slight crest directed in an anterior-posterior direction.

The lower epiphysis is cone-shaped with a medially posted process (malleolus tibiale).

The fibula is a long, tubular, and subtle bone. The diaphysis presents the slightly flattened and twisted surface. The upper epiphysis (head) is ovoid with a facet of articulation with the tibia. The lower epiphysis (lateral or fibular malleolus) is slightly enlarged in respect to the body. It is elongated with a slightly rounded apex.

The tarsus, the posterior part of the skeleton of the foot, is formed by the anklebone joined with the tibia; the heel, which is a cuboid form and projected posteriorly; the scaphoid; the cuboid; and the three cuneiforms.

The metatarsus is the median part of the skeleton of the foot. It is made up of five long bones, the metatarsi.

The phalanges are the skeletons of the toes and have structural and morphological characteristics similar to those of the hand. There are only two phalanges present in the big toe and three in the remaining four.

Notes on Arthrology

The joints of the lower limbs also present relevant similarities of disposition to those of the upper limbs. They are distinguishable into three groups: the joints of the pelvic enclosure, essentially those of the pelvis (iliac-sacrum and pubic symphysis, see page 46); the coxo-femoral articulations, the knee joints, tibio-tarsal and tibio-fibular joints; and the joints of the foot.

The head of the femur and the pelvis in the acetabulum cavity separates the hip joint (coxofemoral). Both joint surfaces are covered by cartilage. They are held together by a robust capsule reinforced by fibrous ligaments and other muscular tendons. The movements of the lower limbs depend on these joints.

The knee joint, located between the femur and the tibia, is complex due to the morphological characteristics of the joint head at contact. The bone parts that intervene to form the articulation are the condyles of the femur, the upper extremity of the tibia, and the profound surface of the kneecap. The joint surfaces are very discordant in form and therefore linked by semilunar cartilage meniscus. A robust capsule on which some tendon expansions and numerous ligaments are stratified (kneecap, collateral, back of the knee, etc.) envelops the three bones of the entire joint. They confer stability at the joint during movements of flexion and extension.

The tibio-tarsal joint links the lower leg with the foot since it is located between the lower surface of the tibia, the anklebone, and the malleolus of the fibula. A capsule reinforced by some ligaments encloses it and allows only movements of flexion and extension in the foot.

The tibio-fibular joints allow minimal movements. There are two of these joints: the upper, between the head of the fibula and the corresponding tibia surface, and the lower, between the lower extremity of the fibula and the distal epiphysis of the tibia. The joints of the foot are less relevant from a functional point of view than those of the hands. Given the minor services of the organs of support, they are delegated prevalently to sustain the weight of the body and maintain equilibrium.

Tavola 59 : Aspects of the female lower limbs

humerus, ulna, radium, carpus, metacarpus, and the phalanges. The bones of the lower limbs are the pelvis, femur, tibia, fibula, tarsus, metatarsus, and the phalanges. The pelvis and the vertebral column (see p. 157) assume a fundamental importance for the spatial situation of the human body, whether static or dynamic.

The bones are of various forms, brief, platelike, irregular, and long. They recognize two extremities, the epiphysis that also constitute the head joints, conjoined by an elongated portion, the diaphysis. For the long bones, it is relevant to consider the mechanical axis (at times different from the anatomic), made up of the straight line that joins the centers of the joints posted at the extremities of the bones.

The internal architecture of the bones rejoins the maximum degree of solidity at the maximum slightness. The long bones of the limbs, or functional corporal segments, are more relevant in locomotion. They have a hollow cylinder form, while the trabeculae of the extremities expanse, positioned in a manner to mechanically reinforce the joint surface, are destined to undergo maximum pressure.

The Joints

At the base of the diverse form of the head joints and at the eventual presence of the joint cavity come classifications of fixed joints (or synarthrosis) and mobile joints (or diarthroses). In each case (for example, in the knee and the shoulder) they are reunited in complex joints.
1) The synarthroses are two junctures of continuity. The interposition of connective tissue or cartilage is completed in this joint union. There are three types: a) the syndesmoses, in which head joints are united by connective fibers. In the structure the bone segments are united by means of the margins (for example, the bones of the cranial box). In the gomphosis, the bone segments are embedded in bone cavity (for example, the teeth); b) Joint segments are united by hyaline cartilage (for example, the ribs); c) The symphysis, in which the segments are united by hyaline and fibrous cartilage (for example, the pubes).
2) The diathroses are also junctures for continuity because the adjoining of the head joints, covered by hyaline cartilage, passes with the interposition of a joint cavity and at times with the joining of a fiber-cartilage disc. A capsule and the ligaments wrap the joints. They are distinguishable as three types: a) The arthrodia, where the joint heads have flat surfaces (for example, the carpus); b) The enarthrosis where the joint heads have a tightly curved spherical form, a concave and a convex (for example, the hip); c) Joint heads have a curved ellipsoide form, a concave and a convex (for example, the temporal-mandible); d) The ginglymus where the joint heads have a cylindrical formed segment, a concave and a convex. There are two varieties of ginglymus. They are the angular ginglymus (or trochlea) at the angle, like the elbow joints and the lateral ginglymus at the posts like the proximal radium-ulna joint and the atlanto-odontoid.

The principle function of the joints is to give the bones the possibility of movement and to complete joint mobility. This must be in limited measure, evading instability or loss of the normal relationship between the joint surfaces.

The limitation factors of joint mobility (or stability) are connected at the bone heads, the system of the capsules and the relative internal pressure, the system of ligaments, and the traction of the adjacent muscles. The three spatial planes, conventionally adopted in the anatomic description, complete the fundamental movements:
1) The movements in the saggital plane (anterior-posterior) are that of flexion (directly across the anterior plane, with diminution in the joint angle) and of extension (directly across the posterior plane or also of simple flexion return). In the limbs they can rejoin more ample degrees of mobility, such as hyper-flexion and hyperextension.
2) The movements in the frontal plane are that of abduction (laterally directed with the elongation of the median plane) and lateral flexion for the movement of the head and the trunk.
3) The movements in the horizontal plane are that of lateral and medial rotation for the forearm of pronation and supination.

The direct principle movements rejoin the limbs in an oblique plane, the intermediate between the frontal and lateral planes and those of circumduction in an ordered sequence of movements that unfold in diverse planes.

The Muscles

The skeletal musculature (striped or voluntary) constitutes the active component of corporal movement. In life, the muscles always conserve a slight degree of physiological contraction or "muscle tone." The effective movements, however, are normally completed across an ordered sequence. The nervous impulse (voluntary) provokes the contraction of muscular tissue at which it is destined (the belly of the muscle). The passage of the tendons determines the displacement of the raised bone.

The active movements of the body or of body segments (different from the passive, which do not require some force because they are executed by others on the body of the subject) are completed almost always with the intervention of numerous muscles other than these specifically responsible for the movement considered. It is a muscular coordination, in which different muscles collaborate to regulate the space, amplitude, or intensity of a corporal placement by means of contrast or facilitation (synergy) of the movement.

The muscles can then assume diverse finalized functions. They can recognize the muscles of sustenance or stabilizers (because they are near the joint heads and track along the bone axis) and muscles of movement. The movement muscles impress a displacement at the mobile bone. In diverse modes, their fibers are in "red" prevalence (rich in hemoglobin), or those which favor the slow or prolonged contraction. They can also be prevalently "white" (low in hemoglobin), or those which favor a rapid and energetic contraction.

The motor muscle (or agonist) is directly responsible for a movement. The immobilization muscle, stabilization muscles, and muscles of sustenance are those in which static contractions sustain part of the body, balancing actions of motor muscles or the force of gravity. The neutralization muscle is opposed to secondary actions provoked by the agonist. The antagonist muscle is that which provokes the opposite movement of that executed by the agonist muscle.

The muscular contraction can be shortening (concentric or isotonic). The muscular belly provokes the

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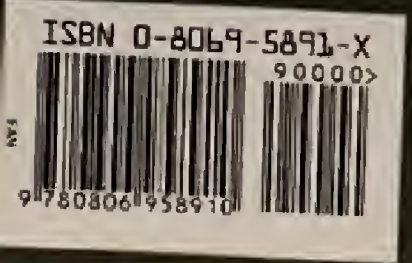

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